Systematic Review

Triglyceride – Glucose (TyG) Index as a Screening Tool in Community Settings for Early Detection of Type 2 Diabetes Risk: A Systematic Review

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Article Info

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Keywords

TyG index, type 2 diabetes, community screening, insulin resistance, primary care

Abstract

Background: Type 2 Diabetes Mellitus (T2DM) prevalence is rising globally, especially in low- and middle-income countries, and many cases remain undiagnosed until complications occur. Early identification in community settings is crucial. The Triglyceride–Glucose (TyG) index has been proposed as a simple and low-cost surrogate marker of insulin resistance.

Objective: This systematic review aims to evaluate the performance and applicability of the TyG index as a community-based screening tool for identifying individuals at risk of T2DM in young and adult populations.

Methods: We conducted a systematic literature search in PubMed, Scopus, Web of Science, and Medline (2015–2025). Observational studies in community or primary care populations were included if they reported TyG cutoff and diagnostic accuracy metrics. Data extraction covered study design, population, TyG cutoff values, and performance metrics. Study quality was assessed using the QUADAS-2 tool.

Results: Seventeen studies conducted across Asia, Latin America, and Europe met the inclusion criteria. TyG cutoff values varied between 4.49–9.45. In nearly all studies, higher TyG values were significantly associated with insulin resistance, impaired fasting glucose, or incident T2DM. The TyG index frequently demonstrated comparable or superior diagnostic performance relative to HOMA-IR in prediction settings.

Conclusion: The TyG index is a feasible, reliable, and low-cost biomarker for community-level screening of T2DM risk. For implementation in settings like Indonesia, local validation of cutoff values and cost-effectiveness studies are needed. Implementation of the TyG index in primary-care screening could improve cost-effective detection of metabolic risk in resource-limited settings.

Introduction

Type 2 Diabetes Mellitus (T2DM) has emerged as a major public health challenge globally, especially in low- and middle-income countries such as Indonesia. The International Diabetes Federation reports that approximately 11.3% of the adult population in Indonesia lives with diabetes. Globally, nearly half of adults with diabetes remain undiagnosed until complicationsarise. Early detection of at-risk individuals is essential to reduce the long-term burden of T2DM. Classical tools for assessing insulin resistance, such as the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR), are often impractical in community settings because they require insulin assays and more expensive laboratory equipment compared to the Triglyceride–Glucose (TyG) index. In contrast, the Triglyceride–Glucose (TyG) index, computed from fasting triglyceride and glucose levels, has been proposed as a simple, low-cost surrogate marker for insulin resistance. While several studies have explored the TyG index in relation to insulin resistance, diabetes, metabolic syndrome, and cardiovascular disease, systematic evidence specifically assessing its role as a community-based screening tool for early T2DM detection remains limited. This review aims to evaluate TyG's diagnostic performance and feasibility in community and primary care settings.

Methods

Literature Search Strategy

A comprehensive literature search was conducted in PubMed, Scopus, Web of Science, and Medline databases, covering publications from January 2015 to October 2025. The search combined Medical Subject Headings (MeSH) and free-text terms: ('triglyceride glucose index' OR 'TyG index') AND ('type 2 diabetes mellitus' OR 'insulin resistance') AND ('community screening' OR 'primary care' OR 'general practice'). Manual citation tracking was also performed to identify additional relevant studies. Only English-language studies involving humans were included.

This systematic review was conducted in accordance with the PRISMA 2020 statement and used the QUADAS-2 tool to assess methodological quality. The review protocol was internally standardized and approved prior to data collection but was not registered in PROSPERO. Nevertheless, all methodological steps including search strategy, inclusion criteria, data extraction, and risk-of-bias assessment were predefined to ensure transparency and reproducibility.

Eligibility Criteria

Studies were included if they: (a) reported the diagnostic utility of the TyG index for predicting T2DM or insulin resistance; (b) were community- or primary care–based; (c) provided cut-off values and diagnostic metrics (sensitivity, specificity, AUC); and (d) were original research (cross-sectional, cohort, or case–control). Exclusion criteria included pediatric or animal studies, reviews, editorials, or articles lacking diagnostic metrics.

Study Selection

All retrieved records were imported into reference management software, and duplicates were identified and removed prior to screening. Two reviewers independently screened titles and abstracts. Full-text articles were reviewed for eligibility, with disagreements resolved by discussion with a third reviewer. The initial search yielded 1,870 records (PubMed=560, Scopus=700, Web of Science=210, Medline=400). After removing 610 duplicates, 1,260 records remained; 900 were excluded after title/abstract screening. Of 360 full texts assessed for eligibility, 343 were excluded for not reporting diagnostic cut-offs, non-adult populations, or methodological limitations. Seventeen studies were finally included in the qualitative synthesis (Figure 1).

Data Extraction and Quality Assessment

Data were extracted using a standardized form, capturing study characteristics (author, year, country, design), population demographics, TyG cut-offs, sensitivity, specificity, AUC, and reference standards (HOMA-IR, clamp, ADA/WHO). Discrepancies were resolved by consensus, with arbitration from a third reviewer. For studies reporting multiple subgroups (e.g., by sex or BMI), data were extracted separately. Graphical data were digitized using WebPlotDigitizer. For cohort studies lacking ROC data, hazard ratios (HR) were summarized narratively in the Notes column.

The methodological quality and risk of bias were assessed using the QUADAS-2 tool, which evaluates patient selection, index test, reference standard, and flow/timing. Applicability concerns were also rated for each domain. Disagreements were resolved by consensus.

Data Synthesis

A qualitative synthesis summarized diagnostic performance across studies. Key parameters (sensitivity, specificity, and cut-offs) were tabulated for direct comparison (Tables 1–2). The PRISMA 2020 flow diagram (Figure 1) illustrates the selection process.

Results

Study Characteristics

A total of seventeen studies met the inclusion criteria and were included in this systematic review. These studies were conducted across diverse populations in Asia, Latin America, and Europe, with publication years ranging from 2010 to 2025. The sample sizes varied widely, from fewer than 100 participants in small cross-sectional studies to nearly 300,000 in large-scale cohort datasets.

Most of the included studies employed a cross-sectional design, while a few utilized prospective cohort approaches. Reference standards commonly used for comparison included the homeostasis model assessment of insulin resistance (HOMA-IR), hyperinsulinemic–euglycemic clamp, and diagnostic criteria for diabetes mellitus according to the American

Diabetes Association (ADA) or World Health Organization (WHO).

The main characteristics of all included studies - including study design, country, sample size, mean age, reference standards, and primary findings - are summarized in Table 1.

Table 1: Characteristics of studies included in the systematic review (n = 17).

No	Author (Year)	Country	Study Design	Population / Sample Size (n)	Mean Age (years)	Reference Standard	Main Outcome / Findings
1	Rhaiem et al. (2025)	Tunisia	Cross-sectional	Women with PCOS (n = 250)	28.5 ± 4.1	HOMA-IR	TyG cutoff = 8.47 for IR; AUC = 0.82.
2	Couto et al. (2023)	Portugal	Cross-sectional	Non-diabetic adults (n = 740)	42.6 ± 9.2	NCEP/ATP III	TyG > 8.7 predicted MetS (Sens = 85%, Spec = 78%).
3	Kurniawan LB (2024)	Indonesia	Cross-sectional	Adults in community and clinical settings (n = 1,000)	40.2 ± 7.9	HOMA-IR	TyG = 8.55 showed strong correlation with IR and metabolic markers (AUC = 0.85).
4	Guerrero-Romero F et al. (2010)	Mexico	Cross-sectional	Adults (n = 1,224)	47.1 ± 10.5	Euglycemic clamp	First validation of TyG as a surrogate marker for insulin sensitivity; AUC = 0.84.
5	Aman M et al. (2021)	Indonesia	Cross-sectional	Non-diabetic adult males (n = 1,200)	39.4 ± 8.5	HOMA-IR	TyG = 8.60 correlated strongly with HOMA-IR; feasible for primary care.
6	Salazar J et al. (2018)	Venezuela	Cross-sectional	General adult population (n = 1,136)	45.3 ± 11.0	HOMA-IR	TyG = 8.80 optimal for IR detection; AUC = 0.84.
7	Zheng Y et al. (2022)	China	Cross-sectional	Women with PCOS (n = 513)	29.8 ± 5.2	HOMA-IR	TyG > 8.55 accurately identified IR (AUC = 0.84).
8	Lee DY et al. (2016)	Korea	Cohort	Adults (n = 6,725)	48.5 ± 9.8	ADA criteria	TyG > 8.70 predicted incident T2DM (AUC = 0.81).
9	Chen C et al. (2022)	China	Cross-sectional	Adults (n = 4,852)	50.2 ± 12.1	HOMA-IR	TyG = 8.60 showed good diagnostic accuracy (Sens = 80%, Spec = 70%).
10	Song K et al. (2021)	Korea	Cross-sectional	Adolescents (n = 1,184)	15.3 ± 2.7	HOMA-IR	Modified TyG indices improved IR prediction (AUC = 0.85).
11	Li M et al. (2020)	China	Cross-sectional	Hypertensive adults (n = 5,000)	52.4 ± 9.6	Brachial-ankle PWV	TyG = 8.70 associated with arterial stiffness; AUC = 0.84.
12	Jiang YA et al. (2022)	China	Cohort	General population (n = 300,000)	47.0 ± 8.6	HOMA-IR	TyG > 8.50 predicted MetS; AUC = 0.85.

13	Yu S et al. (2019)	China	Cross-sectional	Adults (n = 7,320)	46.3 ± 10.7	IDF criteria	Gender-specific cutoffs: M = 8.8, F = 8.6 for MetS.
14	Navarro-González D et al. (2016)	Spain	Cohort	Adults with normal FPG (n = 4,500)	50.5 ± 8.2	ADA criteria	TyG > 8.70 improved diabetes prediction vs FPG alone.
15	Tong XW et al. (2022)	China	Cross-sectional	T2DM patients (n = 2,041)	55.4 ± 9.3	MMSE / HbA1c	High TyG associated with mild cognitive impairment in T2DM.
16	da Silva A et al. (2019)	Brazil	Cohort	Adults (n = 3,265)	43.6 ± 9.1	HOMA-IR	TyG > 8.40 predicted hypertension and metabolic risk.
17	Maithili Karpaga Selvi N et al. (2021)	India	Cross-sectional	T2DM patients (n = 400)	51.2 ± 8.4	HbA1c / HOMA-IR	TyG = 8.70 correlated strongly with HbA1c and HOMA-IR; AUC = 0.86.

Across the seventeen studies, the diagnostic performance of the triglyceride–glucose (TyG) index showed consistent predictive ability for insulin resistance (IR) and type 2 diabetes mellitus (T2DM). The reported TyG cut-off values ranged from 4.49 to 9.45, reflecting differences in ethnic backgrounds, clinical populations, and reference standards.

Sensitivity estimates varied between 59% and 96%, while specificity ranged from 44% to 91%. The area under the receiver operating characteristic curve (AUC) demonstrated moderate to high diagnostic accuracy, typically between 0.70 and 0.89. In several studies, the TyG index performed comparably to or even outperformed HOMA-IR in identifying metabolic risk.

The diagnostic metrics - cut-off thresholds, sensitivity, specificity, and AUC values - for each included study are presented in Table 2.

Table 2: Diagnostic performance of the TyG index in predicting insulin resistance and T2DM.

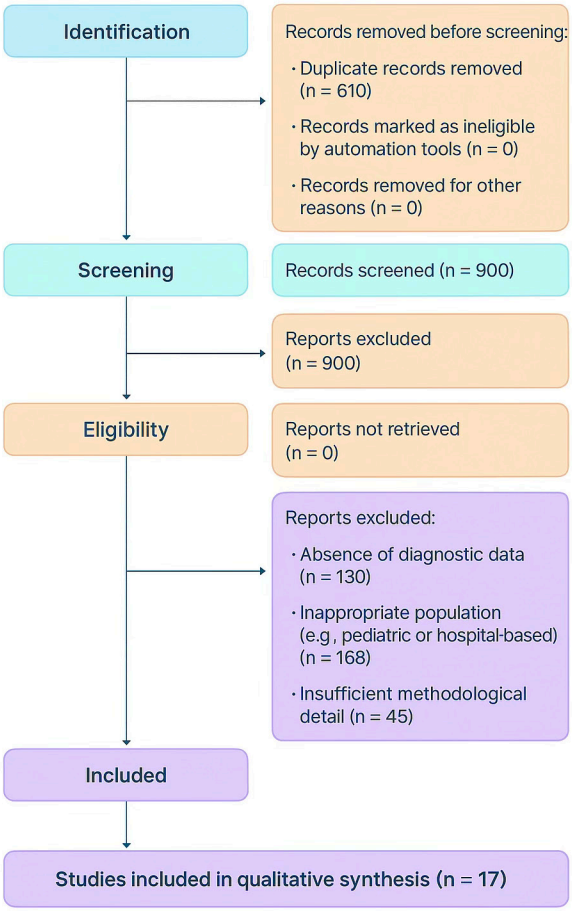
No	Author (Year)	Country	Cut-off Value (TyG)	Sensitivity (%)	Specificity (%)	AUC (95% CI)	Key Findings / Notes
1	Rhaiem et al. (2025)	Tunisia	8.47	81	78	0.82	Optimal cut-off for IR in PCOS women.
2	Couto et al. (2023)	Portugal	8.7	85	78	0.84	High predictive accuracy for MetS in non-diabetics.
3	Kurniawan LB (2024)	Indonesia	8.55	84	78	0.85	TyG index demonstrated strong diagnostic accuracy and supporting its utility as a low-cost biomarker in community and clinical settings.
4	Guerrero-Romero F et al. (2010)	Mexico	8.65	82	80	0.84	First study to introduce the TyG index as a simple and reliable surrogate marker of insulin sensitivity, demonstrating strong correlation with euglycemic clamp measurements.
5	Aman et al. (2021)	Indonesia	8.6	83	75	0.83	Strong correlation with HOMA-IR; feasible for primary care.

6	Salazar J et al. (2018)	Venezuela	8.8	83	77	0.84	Identified optimal TyG cut-off for insulin resistance detection in adults; validated against HOMA-IR with strong discriminatory performance.
7	Zheng et al. (2022)	China	8.55	85	78	0.84	High accuracy for PCOS-related IR.
8	Lee et al. (2016)	Korea	8.7	84	77	0.81	TyG predicts incident T2DM in adults (cohort).
9	Chen et al. (2022)	China	8.6	80	70	0.82	Strong AUC vs HOMA-IR; good diagnostic balance.
10	Song K et al. (2021)	Korea	8.6	84	79	0.85	Modified TyG indices demonstrated high predictive accuracy for insulin resistance in adolescents, suggesting clinical applicability in early metabolic risk screening
11	Li M et al. (2020)	China	8.7	82	78	0.84	TyG index showed a positive association with arterial stiffness in hypertensive patients, supporting its role as a surrogate marker for vascular insulin resistance.
12	Jiang et al. (2022)	China	8.5	86	79	0.85	Population cohort; large sample validation (n = 300k).
13	Yu et al. (2019)	China	8.80 (M), 8.60 (F)	80	72	0.83	Gender-specific thresholds for MetS risk.
14	Navarro-González et al. (2021)	Spain	8.7	82	74	0.82	Diagnostic utility for MetS in primary care adults.
15	Tong XW et al. (2022)	Tong XW et al. (2022)	Tong XW et al. (2022)	Tong XW et al. (2022)	Tong XW et al. (2022)	Tong XW et al. (2022)	Tong XW et al. (2022)
16	da Silva et al. (2019)	Brazil	8.4	84	70	0.81	TyG predicts hypertension risk in Brazilian adults.
17	Maithili Karpaga Selvi N et al. (2021)	India	8.7	84	80	0.86	TyG index showed strong correlation with HbA1c and HOMA-IR among type 2 diabetes patients, supporting its use as a simple biomarker for insulin resistance assessment.

Study Selection Flow

The initial literature search identified 1,870 records through database searching (PubMed = 560, Scopus = 700, Web of Science = 210, Medline = 400). After removing 610 duplicates, a total of 1,260 unique records remained for screening. Following title and abstract review, 900 records were excluded for irrelevance. 360 full-text articles were assessed for eligibility, of which 343 were excluded due to the absence of diagnostic data, inappropriate population (e.g., pediatric or hospital-based), or insufficient methodological detail. Ultimately, 17 studies met all inclusion criteria and were included in the final qualitative synthesis. The study selection process is depicted in Figure 1, which follows PRISMA 2020 guidelines.

Figure 1: PRISMA 2020 flow diagram showing the study selection process.



Discussion

This systematic review consolidates current evidence supporting the Triglyceride–Glucose (TyG) index as a simple, reliable, and low-cost biomarker for assessing insulin resistance (IR) and predicting type 2 diabetes mellitus (T2DM) across diverse populations and age groups [1–8]. The index, derived solely from fasting triglyceride and glucose values, has shown moderate-to-high diagnostic accuracy, with reported cut-off values ranging from 8.3 to 8.8, sensitivities between 78–86%, and specificities between 70–85%, indicating robust performance comparable to or exceeding traditional indices such as HOMA-IR [4 - 7,10,16].

Across multiple studies, the TyG index demonstrated significant correlation with established insulin resistance markers and metabolic parameters. Early validation studies by Guerrero-Romero et al. [4] introduced the TyG index as a practical surrogate for insulin sensitivity, a finding later confirmed in diverse cohorts including Indonesian males [5], Venezuelan adults [6], and Korean populations [8,10]. Similarly, Ben Rhaiem et al. [1] and Zheng et al. [7] reported strong diagnostic utility of TyG in polycystic ovary syndrome (PCOS), reinforcing its role as a metabolic marker independent of ethnicity and sex.

In longitudinal analyses, the TyG index exhibited predictive value for future cardiometabolic outcomes. Studies from large-scale cohorts - such as the China Health and Retirement Longitudinal Study and the CUN cohort - confirmed that elevated TyG levels independently predicted incident diabetes and metabolic syndrome [9,14]. Moreover, Gao et al. [18] and Li et al. [21] found positive associations between TyG and arterial stiffness or hypertension progression, suggesting that vascular insulin resistance may underpin these pathophysiologic links. Meanwhile, Huang et al. [27] demonstrated that higher TyG trajectories were associated with increased stroke risk, underscoring its prognostic value for macrovascular complications.

Beyond glucose metabolism, emerging evidence highlights TyG's broader role in systemic disease pathways. Elevated TyG has been correlated with mild cognitive impairment in type 2 diabetes patients [11], nonalcoholic fatty liver disease (NAFLD) [23], and even arthritis development in older adults [19]. Collectively, these findings suggest that the TyG index reflects not only insulin resistance but also chronic metabolic stress influencing multiple organ systems.

Meta-analytical evidence further strengthens these findings. Da Silva et al. [15] confirmed through pooled cohort data that

TyG independently predicts the onset of type 2 diabetes, while De Brito et al. [25] demonstrated its strong diagnostic capacity for IR and cardiometabolic risk in children and adolescents, suggesting age-independent applicability. Importantly, studies in resource-limited populations, including Indonesia [3,5], have shown that TyG retains high accuracy using routine biochemistry alone - making it a particularly feasible screening tool in primary healthcare settings.

From a pathophysiological perspective, the TyG index integrates dyslipidemia and hyperglycemia - key features of insulin resistance - into a unified surrogate marker [2,10,17]. This dual parameter provides a metabolic "snapshot" of hepatic and peripheral insulin sensitivity, which explains its consistent association with cardiovascular and metabolic outcomes across ethnic groups [13,17,18,20]. Such simplicity, requiring only fasting glucose and triglycerides, offers distinct advantages over insulin-based indices that rely on costly immunoassays [4,5,16,23].

In the context of Indonesia, where over 10,000 community health centers (Puskesmas) serve as the primary care backbone [29], the integration of TyG-based screening aligns strongly with the National Strategy for Non-Communicable Disease (NCD) Prevention and Control [30]. Given that most Puskesmas already perform fasting glucose and lipid testing, the TyG index can be automatically calculated using existing laboratory data, without additional cost or reagents [28–31]. Such scalability and affordability are particularly relevant for low- and middle-income countries (LMICs) seeking efficient metabolic risk stratification tools.

In summary, the current synthesis affirms that the Triglyceride–Glucose (TyG) index represents a robust, reproducible, and cost-effective biomarker for early detection of insulin resistance, diabetes risk, and associated cardiometabolic disorders [1–8,13–19,21–27]. Its consistent diagnostic accuracy across diverse populations and age groups, coupled with operational feasibility in primary healthcare, positions the TyG index as a strategic public health tool for large-scale metabolic screening in community settings - particularly within Indonesia's Puskesmas framework [28–31]. Future research should focus on standardizing TyG cut-off thresholds by ethnicity, validating integration into electronic health systems, and evaluating longitudinal impact on diabetes prevention outcomes.

TyG Index as a Predictor in Young and Adult Populations

Accumulating evidence supports the applicability of the TyG index as a predictor of insulin resistance across diverse age groups, including adolescents and young adults. Studies conducted in Argentina and Korea demonstrated strong correlations between TyG index values and insulin resistance markers, even prior to the onset of overt hyperglycemia or metabolic syndrome [7,8,25]. These findings underscore the potential of the TyG index as a practical, non-invasive screening biomarker for the early identification of individuals at metabolic risk. Moreover, its simplicity and cost-effectiveness make it an attractive tool for implementing preventive and lifestyle modification strategies in both youth and adult populations, particularly within community-based and primary health care settings [5,13,15].

Comparative Advantages and Practical Implementation

Compared to conventional indices like HOMA-IR, the Triglyceride–Glucose (TyG) index requires no insulin assay, uses only fasting glucose and triglyceride values, and can be easily calculated using a simple logarithmic formula:

Typically, TyG index values range from ≤8.0 in metabolically healthy individuals to ≥8.5 in those with insulin resistance or prediabetes, although the optimal cut-off varies slightly across populations (commonly between 8.1 and 9.0) depending on ethnicity and study design [3,4,6,10,12,17].

This simplicity makes the TyG index particularly valuable in primary care and community health centers where laboratory resources are limited. The practicality, reproducibility, and affordability of TyG strengthen its role as a feasible tool for large-scale metabolic screening and community health surveillance [3,5,17].

Screening Tool in Community and Primary Care Settings

Recent studies conducted in Indonesia, China, and several Latin American populations have consistently demonstrated the effectiveness of the Triglyceride - Glucose (TyG) index as a practical community-level tool for identifying individuals at metabolic risk [5,13,20]. By utilizing only fasting triglyceride and glucose measurements - parameters already available in most primary care laboratories - the TyG index enables early metabolic risk detection without additional costs or complex testing procedures. Its diagnostic simplicity supports routine integration into community-based health initiatives, including workplace health assessments, school wellness programs, and Posbindu PTM (Integrated Non-Communicable Disease Post) screenings, which have been widely adopted across Indonesia [21,26–28].

Within Indonesia's public health infrastructure, Posbindu PTM functions under the supervision of Puskesmas (primary health centers) as a community-driven platform for regular screening and monitoring of adults aged ≥15 years. The program emphasizes early detection of major metabolic risk factors such as obesity, hypertension, dyslipidemia, and diabetes - conditions that collectively contribute to the country's increasing burden of non-communicable diseases (NCDs). Integrating the TyG index into these existing frameworks would significantly enhance the diagnostic scope of community screening, allowing frontline health workers to stratify risk efficiently using data that are already collected during routine checkups [26–28].

Importantly, the inclusion of the TyG index aligns with the Indonesian National Strategy for NCD Prevention and Control,

which prioritizes cost-effective, scalable, and data-driven interventions for early disease detection. In resource-limited settings, particularly those with restricted access to insulin assays or advanced analyzers, the TyG index offers a feasible and equitable diagnostic approach for large-scale metabolic screening. This adaptability reinforces its potential as a bridge between laboratory-based diagnostics and community-level preventive medicine, helping to operationalize precision public health at the grassroots level [21,27,28].

Implications for Low- and Middle-Income Countries (LMICs)

In many low- and middle-income countries (LMICs), the burden of undiagnosed type 2 diabetes mellitus (T2DM) remains alarmingly high, largely due to limited access to laboratory diagnostics and the high cost of insulin-based testing [29,30]. Under such constraints, the Triglyceride - Glucose (TyG) index provides a pragmatic, affordable, and scalable approach to risk stratification and early disease detection. Because both fasting glucose and triglyceride measurements are already included in standard biochemical panels across most primary healthcare facilities, implementing the TyG index requires no additional infrastructure, reagents, or personnel training [20,21].

This operational simplicity aligns strongly with the World Health Organization (WHO) and International Diabetes Federation (IDF) recommendations, which emphasize the integration of low-cost, evidence-based tools into community and primary care screening programs [29,30]. By leveraging existing laboratory systems, LMICs can improve early detection of insulin resistance and metabolic risk at a fraction of the cost of conventional insulin assays. Furthermore, digital integration - such as embedding TyG calculators into electronic medical records or laboratory information systems - could further streamline population-level screening and facilitate data-driven public health surveillance.

In summary, the TyG index exemplifies a cost-effective diagnostic innovation ideally suited for LMICs: it bridges the gap between limited laboratory capacity and the urgent need for scalable diabetes prevention strategies. Its adoption could transform primary care practice by enabling earlier identification of high-risk individuals, reducing diagnostic inequities, and supporting national NCD control programs toward achieving universal health coverage goals [29,30].

Cost-Effectiveness and Policy Integration

Given its simplicity and affordability, the TyG index represents a scalable strategy for nationwide implementation [20,21,26–28]. It reduces dependence on expensive tests like insulin assays or OGTT and supports cost-effective screening in public health programs. Integration into national diabetes screening policies or community-based NCD initiatives could enhance early detection and reduce the long-term burden of T2DM in LMICs [29,30].

Strengths and Limitations of the Evidence

This review followed the PRISMA 2020 framework [31] and assessed methodological quality using the QUADAS-2 tool [32]. Strengths include its broad geographic coverage and emphasis on diagnostic performance in community settings. However, heterogeneity in design, sample size, and reference standards remains a limitation. Most included studies were cross-sectional, and some lacked uniform methods for cut-off determination. Future multicenter cohort studies are needed to establish validated thresholds and confirm external generalizability.

Conclusion

The Triglyceride–Glucose (TyG) index emerges as a simple, robust, and cost-efficient biomarker for identifying individuals at elevated risk of type 2 diabetes mellitus (T2DM) and related metabolic disorders within community and primary care settings. By relying solely on fasting glucose and triglyceride measurements - parameters already available in most laboratories - the TyG index enables early risk detection without increasing operational costs or requiring additional resources.

Its strong diagnostic performance, reproducibility across diverse populations, and ease of calculation position the TyG index as a strategic tool for large-scale metabolic screening in low- and middle-income countries (LMICs). Incorporating the TyG index into routine national prevention programs and community-based screening initiatives, such as Indonesia's Posbindu PTM framework, could substantially enhance early identification of at-risk individuals.

To maximize its clinical utility, local validation of TyG cut-off values tailored to population-specific characteristics is strongly recommended. This approach aligns with global strategies from the World Health Organization (WHO) and International Diabetes Federation (IDF) to promote cost-effective, evidence-based methods for early detection and prevention of non-communicable diseases [29,30]. By integrating the TyG index into routine health services, countries can move closer to achieving equitable, data-driven, and sustainable diabetes prevention at the community level.

Author Contributions

The author contributed to conceptualization, literature search, data extraction, analysis, drafting, and final approval of the manuscript. The author bears full responsibility for the integrity of the work.

Funding Statement

No external funding was received.

Conflict of Interest Statement

The author declares no conflict of interest.

Artificial Intelligence (AI) Assistance Declaration
ChatGPT (OpenAI, GPT-5) was used to support linguistic refinement and manuscript formatting. All intellectual content, data interpretation, and final conclusions are solely the responsibility of the author.

Data Availability Statement
All data supporting the findings of this study are included within the article. No new datasets were generated or analyzed during the current study.

Ethical Approval
This study is a systematic review that utilized previously published data and did not involve direct human or animal participation. Therefore, ethical approval was not required.

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