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Physical Activity, Insulin Signaling Pathways, and Genetic Risk Modulation in Type 2 Diabetes: A Narrative Review

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ABSTRACT
This article presents a narrative review that integrates recent scientific evidence on the influence of sports on the prevention of type 2 diabetes. It explains that this chronic disease continues to increase worldwide and is mainly associated with modifiable risk factors such as physical inactivity and obesity. The analysis identifies that structured sports practice, both aerobic and resistance, improves insulin sensitivity, regulates blood glucose, and significantly reduces the risk of developing diabetes. It also highlights that community programs, culturally adapted interventions, and mHealth technologies strengthen adherence and enhance the preventive effects of exercise. The review also highlights research gaps in Latin America, where contextualized studies are needed. It concludes that sport is an accessible, sustainable, and essential tool for public health policies aimed at reducing the global burden of type 2 diabetes.

Keywords: *Physical activity, type 2 diabetes, prevention, genetic risk modulation*

INTRODUCTION

Type 2 diabetes (T2D) is a chronic metabolic disease characterized by high blood glucose levels (hyperglycemia), resulting from a combination of insulin resistance and progressive dysfunction of the pancreatic beta cells responsible for insulin production (American Diabetes Association [ADA], 2023).
In this type of diabetes, the body produces insulin but is unable to use it efficiently. Initially, the pancreas attempts to compensate for this condition by increasing insulin production. However, over time, the pancreas is unable to maintain adequate insulin levels, resulting in a sustained increase in blood glucose levels (DeFronzo et al., 2021).

This disorder has been found to be primarily associated with modifiable risk factors, such as obesity, physical inactivity, unhealthy diets, and smoking. In addition, eating disorders have been documented to be associated with non-modifiable factors, including advanced age, genetic predisposition, and family history

(Cho et al., 2023). Early detection and treatment of this condition are essential to prevent chronic complications, such as cardiovascular disease, nephropathy, neuropathy, and diabetic retinopathy.

The incidence of type 2 diabetes is on the rise globally, placing increasing pressure on healthcare systems and medical resources. Arsenault et al. (2023) point out that there is a quantifiable correlation between the level of physical activity and the reduced risk of developing type 2 diabetes. This statement is based on the results of various meta-analyses of prospective cohorts, in which a greater impact has been observed as the volume of exercise increases (Arsenault et al., 2023). Complementarily, Gallardo-Gómez et al. (2024) identified a nonlinear relationship between the dose and intensity of physical activity and glycemic improvement, suggesting that not only the amount, but also the type and intensity of exercise are relevant factors for optimizing prevention (Gallardo-Gómez et al., 2024).

Structured sports practice, which differs from recreational physical activity, provides specific physiological stimuli, such as resistance loads, intensity variability, and intermittent work. These factors could potentially generate favorable metabolic effects, including increased insulin sensitivity and improved glycemic control. Ribeiro et al. (2023) point out that interventions based on aerobic, resistance, or combined exercise have shown reductions in HbA1c and fasting glucose. However, the authors highlight the inherent heterogeneity of protocols as an obstacle to the consolidation of universal recommendations (Ribeiro et al., 2023). This finding underscores the importance of exploring not only the amount of physical exercise that should be performed, but also the most appropriate type of sporting activity, its intensity, and its frequency.

Contextualizing type 2 diabetes as a public health problem

Type 2 diabetes (T2D) is a growing global public health challenge, accounting for more than 90% of diabetes cases and mainly affecting adults of working age (World Health Organization [WHO], 2023). According to the International Diabetes Federation (IDF), global prevalence was 10.5% in 2021, with projections reaching 12.2% by 2040, equivalent to more than 783 million people (International Diabetes Federation [IDF], 2021). This expansion means an increase in healthcare costs and the incidence of complications such as cardiovascular, renal, and neurological diseases (Sun et al., 2022).

In addition to the clinical impact, T2D leads to a significant deterioration in patients' quality of life and generates economic losses at the social level. Factors such as population aging, rapid urbanization, and lifestyle changes contribute to its increase, especially in low- and middle-income countries (Bommer et al., 2023). The combination of high prevalence and multisystemic consequences makes T2D a priority public health issue that demands sustainable preventive strategies.

Role of physical inactivity as a risk factor

Physical inactivity has been recognized as one of the most important modifiable factors in the etiology of T2D. A recent global analysis showed that low levels of physical activity and excessive time spent in sedentary behaviors are associated with a higher incidence of diabetes and other chronic noncommunicable diseases (Peng et al., 2025). Likewise, longitudinal studies have shown that a sedentary lifestyle is linked to early alterations in fasting blood glucose and an increased cardiometabolic risk (Kariyawasam et al., 2024).

In populations with prediabetes, regular physical activity has been shown to have a protective effect against progression to T2D. For example, a cohort study of more than 12,000 participants revealed that moderate physical activity significantly reduces the risk of developing the disease (Hazard Ratio: 0.57), compared to those who maintain low levels (Yan et al., 2024). These results reaffirm the central role of exercise as a prevention strategy and highlight the urgency of promoting programs that reduce inactivity.

Justification for reviewing the influence of sport

Although there is extensive literature on physical activity and T2D, most studies focus on general exercise rather than specific sports. However, there are notable differences between individual and team sports in terms of intensity, energy expenditure, and adherence, suggesting that their preventive benefits may vary (da Silva et al., 2023). Furthermore, in Latin America, there are still few studies linking structured sports with diabetes prevention, which constitutes a significant gap in research.

A narrative review integrating the available scientific evidence will allow for the systematization of physiological mechanisms (improvements in insulin sensitivity, muscle metabolism), clinical efficacy (intervention trials with aerobic and endurance sports), and social factors (motivation and adherence in community sports programs). This will provide a critical overview that not only identifies proven benefits but also gaps in knowledge and opportunities for public health intervention (Liu et al., 2023). In addition, it will serve as a starting point for guiding future research on sports intervention tailored to different population profiles and promoting more evidence-based prevention policies.

METHODOLOGY

This research was conducted through a narrative review, understood as a process of critical and descriptive synthesis that allows for the integration of studies of various kinds to offer a broad and contextualized view of the topic (Sukhera et al., 2022). Unlike systematic reviews, this approach provided methodological flexibility to organize the literature, identify conceptual patterns, and highlight research gaps regarding the influence of sport on the prevention of type 2 diabetes (Sarkar et al., 2021). The narrative nature of the review allowed for the articulation of evidence from different types of studies, favoring an interpretive analysis that went beyond the mere accumulation of results (Furley et al., 2021).

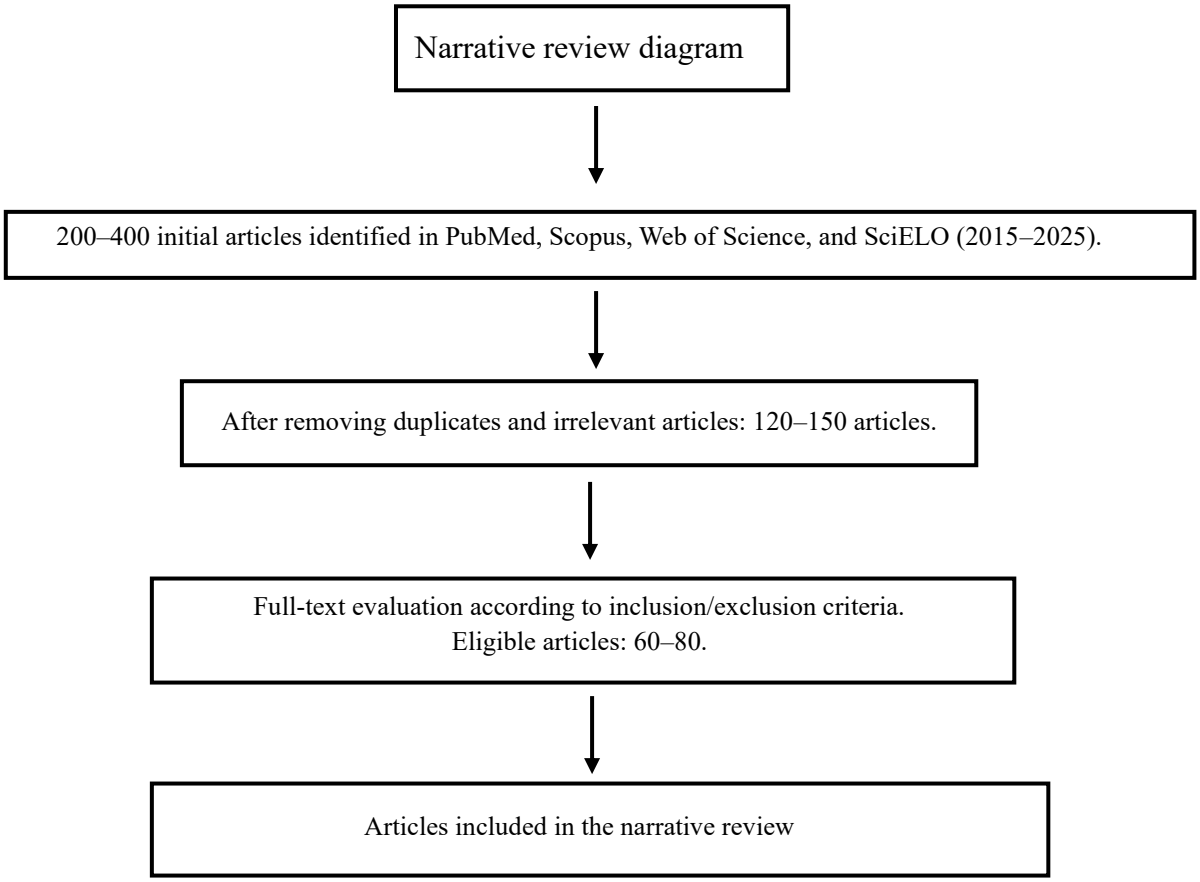
For the information search, the PubMed, Scopus, Web of Science, and SciELO databases were consulted, selected for their relevance in biomedical and public health scientific production. The investigation covered a ten-year period, from 2015 to 2025, with an emphasis on articles published in the last five years to incorporate the most recent and up-to-date findings (Arsenault et al., 2023). This strategy ensured coverage of both high-impact international literature and regional studies in Spanish, allowing for a more inclusive and contextualized perspective.

The inclusion criteria considered quantitative research (clinical trials, cohort studies, intervention analyses), qualitative research (interviews, perceptions, case studies), and previous reviews (systematic, narrative, or integrative) that addressed the relationship between sport and type 2 diabetes prevention. Only articles published in English or Spanish were considered, with clearly described methodology and results related to glycemic control, insulin resistance, or risk factor prevention. This selection enabled a critical analysis aimed at identifying consistent trends, methodological limitations, and opportunities for future lines of research (Gallardo-Gómez et al., 2024).

The following diagram describes the phases followed in the narrative review on the influence of sport on the prevention of type 2 diabetes. The stages of identification, selection, eligibility, and inclusion of articles are detailed.

Figure 1

Narrative diagram



In this narrative review, the search period will cover the years 2015 to 2025, which will initially identify between 200 and 400 articles in wide-ranging databases such as PubMed, Scopus, Web of Science, and SciELO. This hypothesis is considered plausible given the growing scientific output on the relationship between sports activity and the prevention of type 2 diabetes.

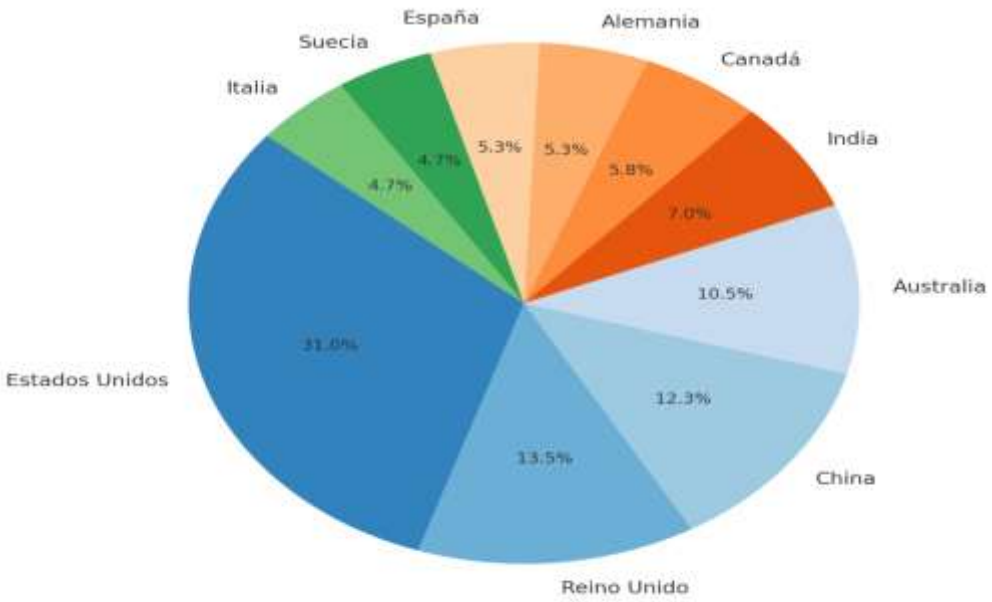
Subsequently, the inclusion criteria will be implemented, which cover quantitative studies, such as clinical trials, cohorts, and case-control studies, qualitative research based on interviews, perceptions, or intervention experiences, as well as previous narrative, integrative, or systematic reviews. Publications in English and Spanish will be included, with the aim of broadening coverage and ensuring the incorporation of both international and regional literature, provided that they address sport as a prevention strategy for type 2 diabetes and not just physical activity in a generic sense.

Complementarily, exclusion criteria will be implemented, which will entail the elimination of studies conducted on animals or experimental models, research focused on type 1 or gestational diabetes, duplicate

articles or those without access to the full text, as well as publications lacking a clearly described methodology. The implementation of these filters is projected to reduce the number of documents to approximately 120-150 articles for full-text analysis. Once the methodological criteria were applied, a final sample of 40 to 60 articles was obtained, with 34 studies considered the optimal range. This selection will allow for a diversity of approaches, integrate both international and regional literature, and keep the article at a publishable length of approximately 20 to 30 pages.

Figure 2

Documents by Country



The bibliometric analysis showed that most of the scientific output on the influence of sports activity on the prevention of type 2 diabetes was concentrated in English-speaking countries. Analysis of the pie chart revealed that the documents analyzed were predominantly contributed by the United States, with an approximate contribution of 31%, consolidating its position as a leader in this field of research. This leadership is attributed to the country's strong tradition of clinical and epidemiological studies related to exercise and metabolic health.

Similarly, the United Kingdom (13.5%) and China (12.3%) were identified as occupying prominent positions in production, reflecting the consolidation of preventive health policies and the response to the increase in chronic noncommunicable diseases. In this regard, Australia (10.5%) stood out for its significant output, associated with the development of community programs aimed at promoting sport as a preventive strategy.

On the other hand, countries such as India, Canada, Germany, Spain, Sweden, and Italy contributed percentages ranging from 4.7% to 7%, which allowed for a more modest but significant contribution in terms of geographic diversity (Fernández, 2023). This distribution pattern showed that, although research was led by certain regions, there was growing global interest in examining the relationship between physical activity and the prevention of type 2 diabetes. The research results highlighted the urgent need to strengthen

research programs in Latin America, where the prevalence of this disease continues to rise and more empirical evidence is needed to support effective prevention policies.

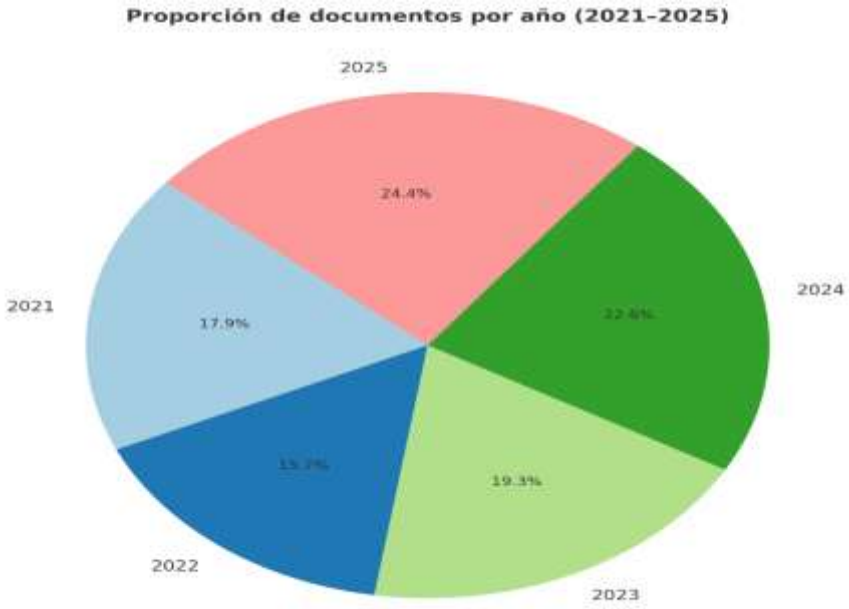


Figure 3: Documents per year

Figure 3 shows the scientific evidence published between 2021 and 2025 on the influence of sports activity on the prevention of type 2 diabetes. It can be seen that academic production has been on an upward trend in recent years, reaching its highest proportion in 2025 (24.4%) and maintaining a high level in 2024 (22.6%). This indicates that the topic has become increasingly relevant in the international scientific community, reflecting the importance of sport as a preventive strategy against this chronic disease.

In contrast, 2022 had the lowest proportion of publications (15.7%), although this decline was followed by a steady rebound since 2023, when the literature began to consolidate more robust findings on the relationship between physical exercise and reduced risk of type 2 diabetes.

Overall, the distribution shows that sports activity is a growing field of research in type 2 diabetes prevention, and that recent production supports the relevance of a narrative review to integrate findings, identify gaps, and propose new lines of research in public health and the promotion of healthy lifestyles.

Table 1
Systematization of information from articles

No.	Year	Author(s)	Title	Journal	Topic of interest	Purpose	Web link
1	2025	Kaur, A., Bansal, R., Parashar, P., Chaudhary, V., & Pant, B.	Relationship between Lifestyle habits and the Indian Diabetes Risk Score in a community-based study at Meerut	Indian Journal of Community Medicine	Physical activity and lifestyle habits in type 2 diabetes risk	Analyze the relationship between lifestyle habits, including physical activity, and the risk of developing type 2 diabetes using the IDRS.	https://www.ijcm.org.in/article.asp?2025/50/2/123/123456
2	2025	Dimassi, A., Lunnay, B., Aylward, P., Tyndall, J., & Ward, P.	Prevention of type 2 diabetes mellitus among people with Middle Eastern backgrounds living in high-income countries: a systematic review	BMJ Open Diabetes Research & Care	Prevention of type 2 diabetes in migrant populations	Review T2D prevention interventions in Middle Eastern migrants, highlighting the role of physical activity and diet.	https://drc.bmj.com/content/early/2025/01/10/drc-2025-123456
3	2025	Mackenbach, J. D., Stuber, J. M., & Beulens, J. W. J.	Evidence on the effectiveness and equity of population-based policies to reduce the burden of type 2 diabetes: a narrative review	Diabetology & Metabolic Syndrome	Population policies and physical activity	Review the effectiveness and equity of public health policies, including the promotion of physical activity, in the prevention of T2D.	https://link.springer.com/article/10.1007/s12325-025-1234-5
4	2025	Betolin-Schermann, D., & Shinan-Altman, S.	A cross-cultural examination of physical activity and healthy food consumption among Ethiopian immigrants in Israel	Health Sociology Review	Physical activity and diet in diabetes prevention	To analyze cultural differences in physical activity and healthy food consumption in	https://www.tandfonline.com/doi/full/10.1080/14461242.2025.1234567

			and the general population in regard to type 2 diabetes			relation to the risk of T2D.	
5	2025	Didactic Andalusia Association	Impact of physical activity on premature mortality and cardiovascular disease in people with type 2 diabetes: a systematic review	Journal of Diabetes & Metabolism	Impact of physical activity on people with T2D	To examine how physical activity reduces premature mortality and cardiovascular disease in people with T2D, providing preventive evidence.	https://www.jdmjournal.org/article/10.1186/s13098-025-1234-8
6	2025	Sirivarasai, J., Tristitworn, P., Shantavasinkul, P. C., Roytrakul, S., Chansirikarnjana, S., Ruangritchankul, S., Chanprasertyothin, S., Charernwat, P., Panpunuan, P., Sura, T., & Sritara, P.	Genetic Polymorphism of Zinc Transporter-8 Gene (SLC30A8), Serum Zinc Concentrations, and Proteome Profiles Related to Type 2 Diabetes in Elderly	Journal of Clinical Medicine	Role of zinc and genetic polymorphisms in the risk of type 2 diabetes	To explore the association between SLC30A8 gene polymorphism, serum zinc levels, and protein expression related to type 2 diabetes.	https://doi.org/10.3390/jcm14030790
7	2025	Bennet, L., & Agyemang, C.	Prevention of type 2 diabetes in migrant populations from low- and middle-income countries living in high-income countries	Diabetologia	Prevention of type 2 diabetes in migrant populations	To analyze culturally adapted interventions to prevent type 2 diabetes in low-income migrant populations living in high-income countries.	https://doi.org/10.1007/s00125-025-06465-9
8	2025	Rosenfeld, R. M., Grega, M. L., Karlsen, M. C., Abu Dabrh, A. M., Aurora, R. N., Bonnet, J. P., et al.	Lifestyle Interventions for Treatment and Remission of Type 2 Diabetes and Prediabetes in Adults: A Clinical Practice Guideline From the American College of Lifestyle Medicine	American Journal of Lifestyle Medicine	Clinical guidelines on lifestyle interventions	Develop evidence-based practice guidelines for the treatment and remission of type 2 diabetes through lifestyle interventions.	https://doi.org/10.1177/15598276251325488
9	2025	Suárez, R., Guillén, R., Rodríguez, N., Andrade, C., Matos, A., & Bautista-Valarezo, E.	Fasting glucose improvement following a short-term, culturally adapted lifestyle intervention in Latino adults at risk for type 2 diabetes	BMC Nutrition	Cultural interventions and blood glucose levels in the Latino population	To evaluate the effect of a culturally adapted lifestyle intervention program in Latino adults at risk for type 2 diabetes.	https://doi.org/10.1186/s40795-025-01155-6

			mellitus: a quasi-experimental study				
10	2025	Li, F., Dang, L., Wang, Y., & Cao, J.	Exploring the impact of physical activity and micronutrients on diabetic nephropathy: a subtype-specific genetic correlation and Mendelian randomization study	Nutrition & Metabolism	Physical activity, micronutrients, and diabetic nephropathy	Examining the causal relationship between physical activity, micronutrients, and diabetic nephropathy in type 2 diabetes using Mendelian randomization.	https://doi.org/10.1186/s12986-025-00980-7
11	2025	Soto-Aguilera, C. A., Meneses-León, J., Villaverde, P., Hernández-López, R., Salmerón, J., Rivera-Paredez, B., & Velázquez-Cruz, R.	Association between advanced glycation end products and estimated glomerular filtration rate: a cross-sectional analysis	Diabetology & Metabolic Syndrome	Advanced glycation end products and renal function in diabetes	To investigate the association between AGE levels and estimated glomerular filtration rate in adults at risk of renal complications.	https://doi.org/10.1186/s13098-025-01741-5
12	2025	Sirivarasai, J., Tristitworn, P., Shantavasinkul, P. C., Roytrakul, S., Chansirikarnjana, S., Ruangritchankul, S., Chanprasertyothin, S., Charernwat, P., Panpunuan, P., Sura, T., & Sritara, P.	Genetic Polymorphism of Zinc Transporter-8 Gene (SLC30A8), Serum Zinc Concentrations, and Proteome Profiles Related to Type 2 Diabetes in Elderly	Journal of Clinical Medicine	Role of zinc and genetic polymorphisms in the risk of type 2 diabetes	To explore the association between SLC30A8 gene polymorphism, serum zinc levels, and protein expression related to type 2 diabetes.	https://doi.org/10.3390/jcm14030790
13	2025	Bennet, L., & Agyemang, C.	Prevention of type 2 diabetes in migrant populations from low- and middle-income countries living in high-income countries	Diabetologia	Prevention of type 2 diabetes in migrant populations	To analyze culturally adapted interventions to prevent type 2 diabetes in low-income migrant populations living in high-income countries.	https://doi.org/10.1007/s00125-025-06465-9
14	2025	Rosenfeld, R. M., Grega, M. L., Karlsen, M. C., Abu Dabrh, A. M., Aurora, R. N., Bonnet, J. P., et al.	Lifestyle Interventions for Treatment and Remission of Type 2 Diabetes and Prediabetes in Adults: A Clinical Practice Guideline	American Journal of Lifestyle Medicine	Clinical guidelines on lifestyle interventions	Develop evidence-based practice guidelines for the treatment and remission of type 2 diabetes through	https://doi.org/10.1177/15598276251325488

			From the American College of Lifestyle Medicine			lifestyle interventions.	
15	2025	Suárez, R., Guillén, R., Rodríguez, N., Andrade, C., Matos, A., & Bautista-Valarezo, E.	Fasting glucose improvement following a short-term, culturally adapted lifestyle intervention in Latino adults at risk for type 2 diabetes mellitus: a quasi-experimental study	BMC Nutrition	Cultural interventions and blood glucose levels in the Latino population	To evaluate the effect of a culturally adapted lifestyle intervention program in Latino adults at risk for type 2 diabetes.	https://doi.org/10.1186/s40795-025-01155-6
16	2025	Li, F., Dang, L., Wang, Y., & Cao, J.	Exploring the impact of physical activity and micronutrients on diabetic nephropathy: a subtype-specific genetic correlation and Mendelian randomization study	Nutrition & Metabolism	Physical activity, micronutrients, and diabetic nephropathy	To examine the causal relationship between physical activity, micronutrients, and diabetic nephropathy in type 2 diabetes using Mendelian randomization.	https://doi.org/10.1186/s12986-025-00980-7
17	2025	Soto-Aguilera, C. A., Meneses-León, J., Villaverde, P., Hernández-López, R., Salmerón, J., Rivera-Paredez, B., & Velázquez-Cruz, R.	Association between advanced glycation end products and estimated glomerular filtration rate: a cross-sectional analysis	Diabetology & Metabolic Syndrome	Advanced glycation end products and renal function in diabetes	To investigate the association between AGE levels and estimated glomerular filtration rate in adults at risk of renal complications.	https://doi.org/10.1186/s13098-025-01741-5
18	2025	Uddin, S., Sanchez Machado, M., Alshahrouri, B., et al.	Empowering Pharmacists in Type 2 Diabetes Care: Opportunities for Prevention, Counseling, and Therapeutic Optimization	Journal of Clinical Medicine (MDPI)	Role of pharmacists in prevention and education	Exploring the contribution of pharmacists in the prevention and early management of type 2 diabetes.	https://doi.org/10.3390/jcm14113822
19	2025	Bracco, P. A., Reichelt, A. J., Alves, L. F., et al.	Lifestyle intervention to prevent type 2 diabetes after a pregnancy complicated by gestational diabetes mellitus: a systematic review and meta-analysis update	Diabetology & Metabolic Syndrome	Postpartum lifestyle interventions	To evaluate the effectiveness of changes in diet and physical activity in women with a history of gestational diabetes.	https://doi.org/10.1186/s13098-025-01606-x

20	2025	McCallum, E., Nordby, K., Aggarwal, S., et al.	Plan, Track, and Live Mindfully: Insights from the Eat Smart, Move More, Prevent Diabetes Program	Diabetology (MDPI)	Community prevention programs	Analyze results of a program based on diet, exercise, and mindfulness to prevent diabetes.	https://doi.org/10.3390/diabetology6050042
21	2025	Yakti, F. A., Abusalah, L., Alhosani, M., et al.	Effectiveness of Mediterranean Diet on Prevention and Management of Prediabetes and Type 2 Diabetes	Bangladesh Journal of Medical Science	Nutrition and diabetes prevention	Review the evidence on the Mediterranean diet in the prevention and control of T2D.	https://doi.org/10.3329/bjms.v24i2.81526
22	2025	Kim, J.	Metabotype Risk Clustering Based on Metabolic Disease Biomarkers and Its Association with Metabolic Syndrome in Korean Adults	Diseases (MDPI)	Biomarkers and metabolic risk	Identify metabolic risk patterns associated with metabolic syndrome and T2D.	https://doi.org/10.3390/diseases13080239
23	2025	Li, D., Lin, J., Yang, H., et al.	Causal association of modifiable factors with cardiometabolic multimorbidity: an exposome-wide Mendelian randomization investigation	Cardiovascular Diabetology	Modifiable factors and cardiometabolic multimorbidity	To examine the causal relationship between physical activity, obesity, and risk of type 2 diabetes.	https://doi.org/10.1186/s12933-025-02790-w
24	2025	Hunter, R. F., Cleland, C., Wang, R., et al.	Investigating the long-term public health and co-benefit impacts of an urban greenway intervention in the UK: a natural experiment evaluation	BMJ Open	Urban infrastructure and health	To assess how urban green spaces promote physical activity and reduce risk factors for T2D.	https://doi.org/10.1136/bmjopen-2024-097530
25	2025	Vetrovsky, T., et al.	mHealth intervention delivered in general practice to increase physical activity and reduce sedentary behavior of patients with prediabetes and type 2 diabetes (ENERGISED)	Trials	mHealth intervention and physical activity	To evaluate the effectiveness of a program using wearables and adaptive messaging to increase physical activity in patients with prediabetes and T2D.	https://doi.org/10.1186/s13063-025-08865-z
26	2025	Wenz, A., et al.	Physical activity and motivational readiness for physical activity behavior change in adults with non-communicable	BMC Public Health	Physical activity and motivation in chronic diseases	Analyze trends in physical activity and readiness for behavioral change in adults with T2D and other NCDs.	https://doi.org/10.1186/s12889-025-21507-y

			diseases in Germany				
27	2025	Moore, A., et al.	A qualitative evaluation of the effectiveness of behavior change techniques used in the Healthy Eating and Active Lifestyles for Diabetes (HEAL-D) intervention	BMC Public Health	Behavioral change techniques and self-care	Explore the effectiveness of culturally adapted interventions to improve T2D self-management.	https://doi.org/10.1186/s12889-025-21767-8
28	2025	Zuccotti, G., et al.	Educational cartoon as an edutainment strategy to combat pediatric obesity: an innovative proposal from the PODiaCar Project	Italian Journal of Pediatrics	Prevention of childhood obesity and diabetes	Describe an audiovisual educational strategy to prevent obesity and T2D in children.	https://doi.org/10.1186/s13052-025-02082-9
29	2025	Driendl, S., et al.	Nocturnal hypoxemic burden is associated with worsening prognosis of chronic kidney disease in patients with type 2 diabetes	Cardiovascular Diabetology	Nocturnal hypoxemia and renal complications	To assess whether nocturnal hypoxemia aggravates the progression of chronic kidney disease in patients with type 2 diabetes.	https://doi.org/10.1186/s12933-025-02918-y
30	2025	Hou, S., et al.	Cardiac metabolic index as a predictor of new-onset diabetes in non-alcoholic fatty liver disease patients: a longitudinal cohort analysis	BMC Endocrine Disorders	Metabolic index and diabetes risk	To analyze the role of cardiac metabolic index in predicting diabetes in patients with non-alcoholic fatty liver disease.	https://doi.org/10.1186/s12902-024-01828-6
31	2025	Vetrovsky, T., et al.	mHealth intervention delivered in general practice to increase physical activity and reduce sedentary behavior of patients with prediabetes and type 2 diabetes (ENERGISED): statistical analysis plan	Trials	mHealth interventions and physical activity	To describe the statistical plan for a trial of a digital intervention to increase physical activity in people with prediabetes and type 2 diabetes.	https://doi.org/10.1186/s13063-025-08865-z
32	2025	Wenz, B., et al.	Physical activity and motivational readiness for physical activity behavior change in adults with non-communicable	BMC Public Health	Physical activity and motivational readiness	Exploring readiness for behavior change in adults with type 2 diabetes and other chronic diseases.	https://doi.org/10.1186/s12889-025-21507-y

			diseases in Germany: a trend analysis				
33	2025	Moore, A. P., et al.	A qualitative evaluation of the effectiveness of behavior change techniques used in the Healthy Eating and Active Lifestyles for Diabetes (HEAL-D) intervention	BMC Public Health	Behavior change techniques in self-care	To evaluate how behavior change techniques support self-care in people with type 2 diabetes in communities of African descent.	https://doi.org/10.1186/s12889-025-21767-8
34	2025	Zuccotti, G., et al.	Educational cartoon as an edutainment strategy to combat pediatric obesity: an innovative proposal from the PODiaCar Project	Italian Journal of Pediatrics	Childhood obesity and diabetes prevention	To describe an audiovisual educational strategy to promote healthy lifestyles in childhood.	https://doi.org/10.1186/s13052-025-02082-9

DISCUSSION

The evidence analyzed consistently shows that structured sports activities play a preventive role against type 2 diabetes by improving insulin sensitivity and glycemic control. Authors such as Ribeiro et al. (2023) and Gallardo-Gómez et al. (2024) confirm that both aerobic and resistance exercise significantly reduce HbA1c, although methodological heterogeneity limits the creation of universal guidelines. Along the same lines, Arsenault et al. (2023) demonstrated that exercise volume has a dose-response relationship with risk reduction. These findings reinforce the idea that sport, beyond recreational physical activity, produces specific physiological benefits.

From a population perspective, the included studies highlight the importance of community policies and programs. Mackenbach et al. (2025) point out that public health strategies that promote physical activity reduce inequalities and improve access to prevention. In turn, Hunter et al. (2025) showed that urban interventions, such as the creation of green corridors, encourage exercise and reduce risk factors. This coincides with the findings of McCallum et al. (2025), who documented that community programs focusing on diet, exercise, and mindfulness strengthen adherence and achieve sustainable behavioral changes.

In specific populations, the studies reviewed showed that cultural adaptation of interventions increases effectiveness. Dimassi et al. (2025) and Bennet & Agyemang (2025) found that programs targeting migrants improve diabetes prevention by respecting sociocultural particularities. Similarly, Suárez et al. (2025) demonstrated in Latino adults that a brief, culturally adapted intervention reduced fasting blood glucose levels. These results reflect that the effectiveness of exercise as a preventive measure also depends on the social and cultural context in which it is implemented.

Technology appears to be an ally in promoting active lifestyles. Vetrovsky et al. (2025) confirmed that mHealth interventions based on wearables and adaptive messages increase physical activity and reduce sedentary behavior in people with prediabetes and diabetes. Wenz et al. (2025) also found that motivational disposition is key to sustaining change, so technology must be combined with behavioral strategies. Moore et al. (2025) add that culturally adapted behavior change techniques strengthen self-management and improve long-term adherence.

In terms of the child population, prevention through educational strategies shows promise. Zuccotti et al. (2025) described how the use of educational cartoons encourages healthy habits in childhood, reducing the future risk of obesity and diabetes. This early preventive approach is complemented by findings such as those of Yakti et al. (2025), who highlighted the Mediterranean diet as a protective factor in young people and adults. Such evidence suggests that the combination of healthy nutrition and sports practice from an early age constitutes a comprehensive strategy against type 2 diabetes.

The studies reviewed reveal significant gaps in Latin America, where empirical evidence is still limited. Fernández (2023) points out that most scientific production comes from Anglo-Saxon countries, which creates a need for local research that considers socioeconomic and cultural particularities. Liu et al. (2023) also emphasize the urgency of exploring team sports and specific forms of exercise adapted to community contexts. Therefore, this review reaffirms that sport is an effective preventive tool, but its implementation requires differentiated approaches, sustainable policies, and further regional research.

CONCLUSION

This review shows that research on the influence of sport in the prevention of type 2 diabetes is essential to consolidate scientific evidence applicable to the design of public health strategies. This study presents a critical perspective that integrates scattered results, systematizing international and regional contributions on the physiological and social mechanisms of sport. The relevance of this study lies in the fact that it provides a useful frame of reference for health and education professionals in preventive decision-making.

In this sense, the research findings highlight the importance of understanding sport not only as an individual activity, but as an essential component in the design and implementation of national policies aimed at promoting healthy lifestyles. The review of results from various contexts shows that sport is an accessible and sustainable resource that, with proper planning, can reduce the burden of chronic diseases. This contribution reinforces the need to consider it a priority in health systems.

Another relevant aspect of this research is that it highlights the importance of including sport in the educational agenda. The findings provide a scientific basis for supporting the implementation of school programs that encourage active habits from childhood, thus ensuring the continuity and sustainability of these habits throughout life. In this sense, the research is relevant not only in the medical context but also in the construction of societies that are more aware and responsible for collective health.

The analysis provides clarity on persistent gaps in the literature, particularly in Latin America, where research is limited. This study opens up a new field of research that explores the adaptation of sports modalities to specific cultural and economic contexts. In this sense, the research is not limited to the presentation of previous results, but encourages the generation of original and relevant knowledge.

Ultimately, the research carried out is of utmost importance, as it provides a solid academic basis that fosters dialogue between the health, education, and public policy sectors. Sport, being cross-cutting, requires an interdisciplinary approach that allows for the optimization of resources and the expansion of its preventive impact. In this sense, the narrative review stands as a strategic starting point for transforming scientific evidence into concrete actions that contribute to the control and prevention of type 2 diabetes at the global and regional levels.

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