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Research Article

Diabetes Health Indicators: Analysis and Cases reported

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ABSTRACT

Diabetes, a chronic metabolic disorder and silent killer, results from insufficient insulin production or utilization, leading to systemic complications. This study integrates global diabetes data with a local sample from the National Diabetes Center, Mustansiriyah University (Baghdad, Iraq) to provide a comparative perspective. Global data from the *International Diabetes Federation* and *IHME Global Burden of Disease* were analyzed and visualized. Additionally, 50 diabetic patients under treatment and follow-up at the National Center were statistically evaluated using paired sample t-tests in SPSS. Worldwide, diabetes cases reached 536.6 million and are projected to rise to 783.2 million by 2045 (+46%). Undiagnosed cases (239.7 million) and deaths (7.1 million, +71% since 2011) were concentrated in the Western Pacific. Locally, paired t-test results ($t = 7.73$, $t = 8.49$, $p < 0.001$) confirmed significant differences pre- and post-intervention, indicating strong treatment response. By integrating global trends with local patient data, this study highlights the dual challenge of rising prevalence and underdiagnosis worldwide, contrasted with evidence of effective treatment outcomes at a local specialized center.

1. INTRODUCTION

Diabetes mellitus is a chronic disease characterized by hyperglycemia that progressively damages the cardiovascular system, kidneys, eyes, and nerves. It is one of the ten leading causes of disability and death worldwide, with disproportionately higher burdens in developing countries compared to high-income nations. The disease occurs in two primary forms: type 1 diabetes, an autoimmune disorder marked by abrupt insulin deficiency and potential onset of diabetic ketoacidosis; and type 2 diabetes, the more prevalent and insidious form, associated with insulin resistance, obesity, and delayed diagnosis. Beyond genetic predisposition, environmental, lifestyle, and geographic factors significantly influence its prevalence, including among pregnant women and their offspring [1, 2]. Global health organizations such as the International Diabetes Federation (IDF) and the Institute for Health Metrics and Evaluation (IHME) provide extensive estimates of diabetes prevalence, mortality, and trends. However, these global projections often overlook country-specific realities, particularly in low- and middle-income settings where diagnostic capacity, access to care, and treatment outcomes differ markedly from international averages [3-5].

Starting presenting diabetes to people for the first time by observing the initial conditions experienced by the patient, namely: frequent urination, feeling sleepy, blurred vision, feeling tired, headache, nausea, vomiting, stomach pain, unpleasant odor, shortness of breath, dry mouth, physical weakness, mental confusion, coma, and hallucinations. Symptoms of diabetes often begin suddenly, especially for the first type, so doctors advise the need for an initial test of people over the age of (35) to treat cases at the beginning [6]. The most dangerous aspect of this is its presence in pregnant women, which can affect the

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health of the baby and cause complications at birth. The most important thing to treat diabetes is to follow a healthy diet according to the advice of doctor and maintain a healthy weight with regular exercise. As for therapeutic medications, insulin is often used to control blood sugar and other oral medications, with the need to monitor and check blood sugar continuously to avoid any complications that occur. One of the basic treatments that are within the reach of the patient is quitting smoking, and alcohol abuse, living with the disease, constant monitoring and examination, intermittent fasting, and full adherence to the instructions of the attending physician. There are still international medical attempts to find a permanent cure, especially since the current medical drugs discovered are intended to reduce the patient's sugar level and practice his life normally, and not for the final treatment, especially since some specialists consider diabetes one of the types of existing cancers [7, 8].
This study addresses that gap by integrating global diabetes statistics with real-world data from Iraqi patients treated at the National Diabetes Center, Mustansiriyah University in Baghdad. By combining large-scale global projections with localized clinical evidence, the research provides a dual perspective: contextualizing Iraq's diabetes burden within worldwide trends, while simultaneously highlighting the effectiveness of specialized treatment and follow-up in a developing-country setting. This integrated approach offers a novel contribution by bridging the global-local divide in diabetes research and informing both international comparisons and national health policy.

2. MATERIAL & METHODS

The analysis was based on the data published in (International Diabetes Federation), and (IHME Global Burden Disease) and graphically illustrated. A special case of diabetic patients receiving treatment and follow-up at the National Center for diabetes treatment and research and conducting statistical testing of the sample was also studied, all data in this study was deponed on [9-30].
The analysis was based on secondary data published by IDF and IHME Global Burden of Disease database, which were extracted, summarized, and graphically illustrated for global comparisons. In addition, a special sample of 50 diabetic patients receiving treatment and follow-up at the National Diabetes Center, Al-Mustansiriyah University (Baghdad, Iraq), was studied. Patients were selected using convenience sampling from those attending the center during the study period, with inclusion criteria of confirmed diabetes diagnosis (type 1 or type 2), regular follow-up, and complete medical records. Patients with severe comorbidities unrelated to diabetes or incomplete files were excluded.
Ethical considerations: Ethical approval for the study was obtained from the Institutional Review Board (IRB) of Mustansiriyah University, and all participants provided informed consent before inclusion. Patient data were anonymized to ensure confidentiality and compliance with research ethics standards.

3. STATISTICAL ANALYSIS

Data from the local sample were entered and analyzed using SPSS software. A paired sample t-test was chosen to evaluate pre- and post-treatment indicators within the same group of patients. This test was considered appropriate as it compares mean differences in repeated measures for the same subjects, thereby controlling for individual variability. A significance level of $p < 0.05$ was adopted, with results reported as test statistic (t), degrees of freedom (df), and associated p values.

4. RESULTS AND DISCUSSION

The results of the analysis showed that the total cases of diabetes patients were (536.6) million cases in the world, which is expected to increase to (783.2) million cases in (2045), with an increase of (46%), the number of undiagnosed cases globally (239.7) million, most of them in the western Pacific. The number of global deaths was (7102276), an increase of (71%) over the year (2011), most of them also in the western Pacific.
The highest prevalence of diabetes patients aged 20–79 is the western Pacific, with a population of 205.6 million people, Southeast Asia comes in second (90.2) million people, the Middle East and North Africa are in third (72.7) million people, the lowest region is Africa (23.6) million people and globally, the number of people with diabetes is (536.6) million people. The expected number of diabetes patients for the year 2045 was higher compared to the year 2021, but in varying proportions from region to region, the highest percentage was Africa (133%) despite being the region with the lowest number of patients for the year 2021, followed by the Middle East and North Africa (87%), Southeast Asia (68%), and the lowest percentage (5%) was in the region Western Pacific. Globally, the percentage increase for the year 2045 over the year 2021 was 46%. Undiagnosed diabetes cases were the highest in the Western Pacific (108.7) million people and the lowest in South and Central America (10.7) million people. Globally, the number of undiagnosed diabetes patients (239.7) million people makes up more than half of the diagnosed cases as in table I.
The analysis demonstrates the global escalation of diabetes, with 536.6 million cases in 2021 projected to reach 783.2 million by 2045 (a 46% rise). Notably, undiagnosed cases account for 239.7 million globally, exceeding half of diagnosed cases, with the Western Pacific carrying the largest share. While absolute prevalence is highest in China (140.9 million), India (74.2

million), and Pakistan (33 million), Africa shows the steepest projected growth (133%), underscoring disparities between high-burden and high-growth regions.

TABLE. I. PREVALENCE DIABETES IN ADULTS (20 – 79) YEAR IN (2021 & 2045) BY REGION (MILLION)

Region	2021	2045	%	Undiagnosed
Western Pacific	205.6	216.2	5%	108.7
South East Asia	90.2	151.5	68%	46.2
Middle East & North Africa	72.7	135.7	87%	27.3
Europe	61.4	69.2	13%	21.9
North America & Caribbean	50.5	62.8	24%	12.2
South & Central America	32.5	48.9	50%	10.7
Africa	23.6	54.9	133%	12.7
World	**536.6**	**783.2**	**46%**	**239.7**

The highest number of people with diabetes was in China (140.9) million, followed by India (74.2) million and Pakistan (33) million, the lowest was in Egypt (10.9) million. The expected numbers in (2045) have the same sequence as in (2021). The highest undiagnosed was in Indonesia (73.7) million, followed by Egypt (62) million, then India (53.1) million, and the lowest was in the USA (12.5) million as in table II.

TABLE. II. TOP (10) COUNTRIES DIABETES IN ADULTS (20 – 79) YEAR IN (2021 & 2045) (MILLION)

Country	2021	2045	%	Undiagnosed
China	140.9	174.4	24%	51.7
India	74.2	124.9	68%	53.1
Pakistan	33	62.2	88%	26.9
USA	32.2	36.3	13%	12.5
Indonesia	19.5	28.6	47%	73.7
Brazil	15.7	23.2	48%	31.9
Mexico	14.1	21.2	50%	47.5
Bangladesh	13.1	22.3	70%	43.5
Japan	11	21	91%	45.5
Egypt	10.9	20	83%	62

The highest top (10) countries type (1) diabetes aged (20 – 79) year was India (30%), followed by USA (21%), then Brazil (12%), the lowest Saudia Arabia (4%), figure 1.

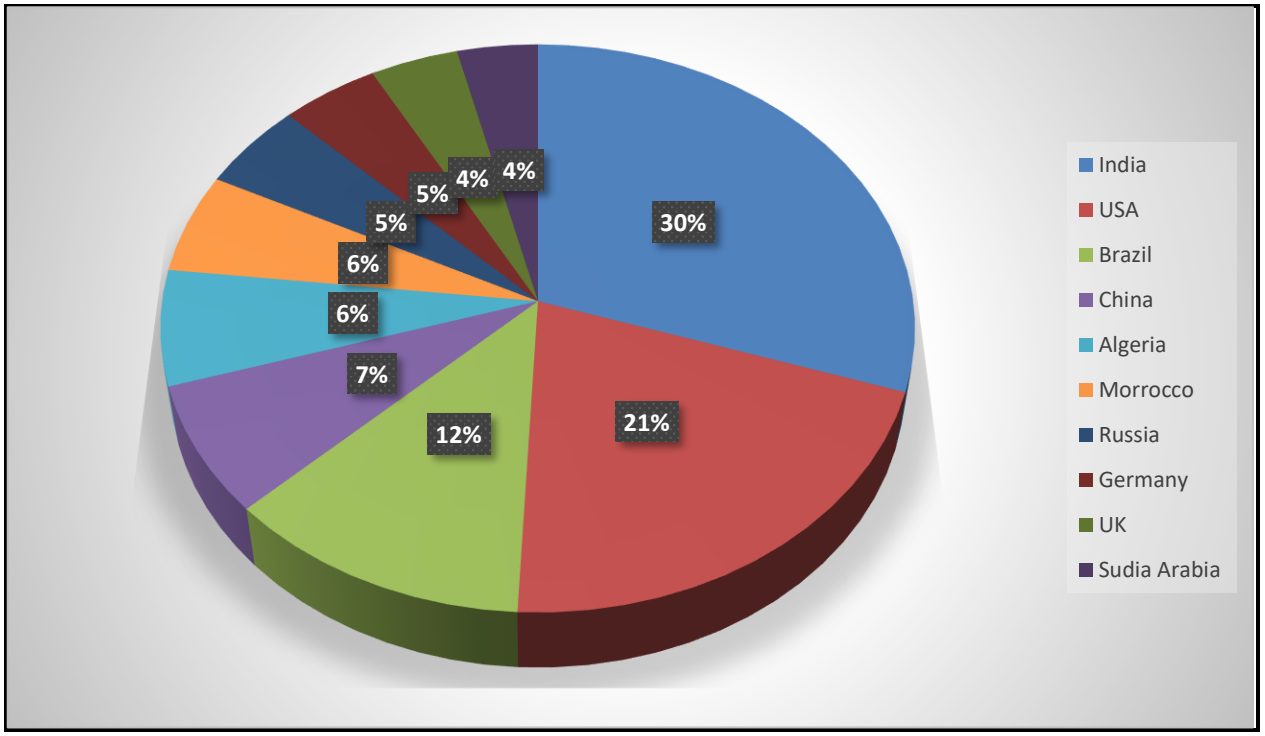

Fig. 1. The highest top 10 countries type 1 diabetes

Table (III) below shows the compression between (2021 and 2045) for the age-adjusted prevalence of impaired glucose tolerance (20 – 79). The highest region for (2021) was the Western Pacific (253 million), followed by Europe (54.8 million), then Africa (52.5 million), and the lowest was South and Central America (39.6 million). The highest region for the

estimated (2045) population was the Western Pacific (291.8) million, followed by Africa (116.3) million, the Middle East and North Africa (80.5) million, and South and Central America (52.5) million. This means there is an increasing pattern of impaired glucose tolerance in Africa (122%), as in Middle East, North Africa (69%) and South East Asia (64%), but an improvement in Europe (1%).

TABLE. III. AGE ADJUSTED PREVALENCE OF IMPAIRED GLUCOSE TOLERANCE (20 – 79), (MILLION)

Region	2021	2045	%
Western Pacific	253	291.8	15%
Europe	54.8	55.3	1%
Africa	52.5	116.7	122%
Middle East & North Africa	47.6	80.5	69%
North America & Caribbean	47	56.6	20%
South East Asia	46.9	76.8	64%
South & Central America	39.6	52.5	33%

For hyperglycemia in pregnancy (20–79), the higher percentage of age-adjusted prevalence was in North America and the Caribbean (20.7%), other regions are almost equally likely. The same analysis can be used for raw prevalence. The highest number of births affected by diabetes were in Southeast Asia (21.1) million, followed by the Western Pacific (3.9), and other regions are equally likely numbers.

TABLE. IV. HYPERGLYCEMIA IN PREGNANCY (20 – 79) YEAR BY REGION

Region	Age Adjusted Prevalence	Raw Prevalence	Number of life birth affected (million)
North America & Caribbean	20.7%	17.2%	1.3
South East Asia	15.2%	16.7%	21.1
South & Central America	13.7%	15.8%	1
Western Pacific	12.4%	14%	3.9
Europe	12.2%	15%	1.6
Africa	11.4%	13%	4.1
Middle East & North Africa	8.6%	14.1%	2.4

4.1 Diabetes Mortality

The highest diabetes mortality for the age (20 – 79) was in Western Pacific, followed by South East Asia, then Europe, the lowest South & Central America. The comparison between the years (2011 & 2021) shows an increasing pattern but in different percentage, the highest was in North America & Caribbean (257%) Although of the health care in this region, followed by Middle East & North Africa, the lowest in Africa (21%), table 5 and figure 2.

TABLE. V. MORTALITY ATTRIBUTABLE TO DIABETES (20 – 79) YEARS IN (2011 & 2021) BY REGION

Region	2011	2021	%
Western Pacific	1708300	2281732	33%
South East Asia	747367	1156000	55%
Europe	600000	1111201	85%
Africa	344500	416163	21%
Middle East & North Africa	276000	796362	189%
North America & Caribbean	260800	930612	257%
South & Central America	227200	410206	81%
Total	**4164167**	**7102276**	**71%**

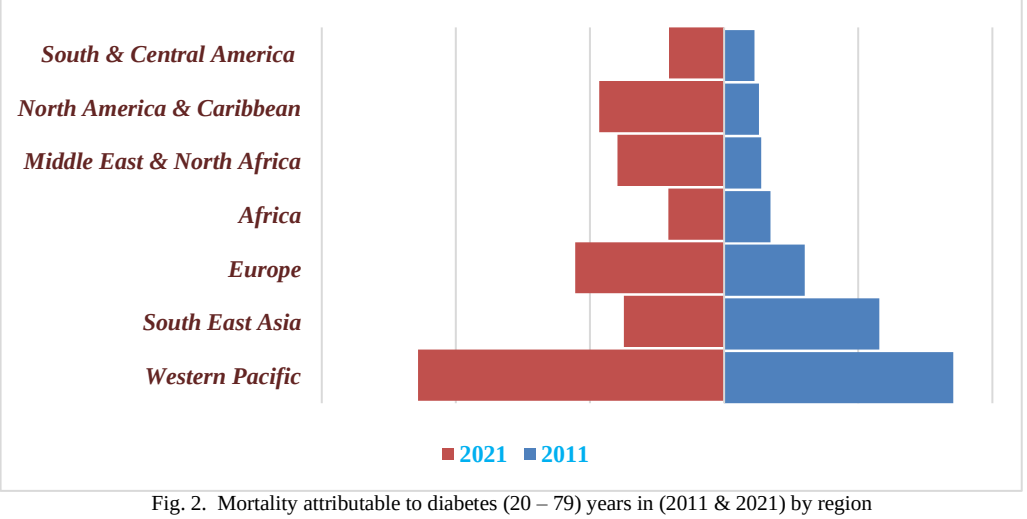

Fig. 2. Mortality attributable to diabetes (20 – 79) years in (2011 & 2021) by region

Table VI. shows the top ten countries mortality diabetes for age (20 – 79) as a compression between (2011 & 2021), the highest was China, followed by India, then USA, the lowest Pakistan in (2011) and Thailand in (2021), the highest percentage of mortality increasing was in USA (273%), Japan (198%), Mexico (159%), the lowest was Thailand (17%), figure 3.

TABLE. VI. TOP (10) COUNTRIES MORTALITY DIABETES (20 – 79) YEAR IN (2011 & 2021)

Country	2011	2021	%
China	1133918	1396662	23%
India	983203	1211024	23%
USA	179612	669384	273%
Indonesia	149872	236711	58%
Bangladesh	144443	187776	30%
Brazil	121082	214175	77%
Japan	81446	243010	198%
Thailand	78846	92361	17%
Mexico	71087	184384	159%
Pakistan	65735	99236	51%

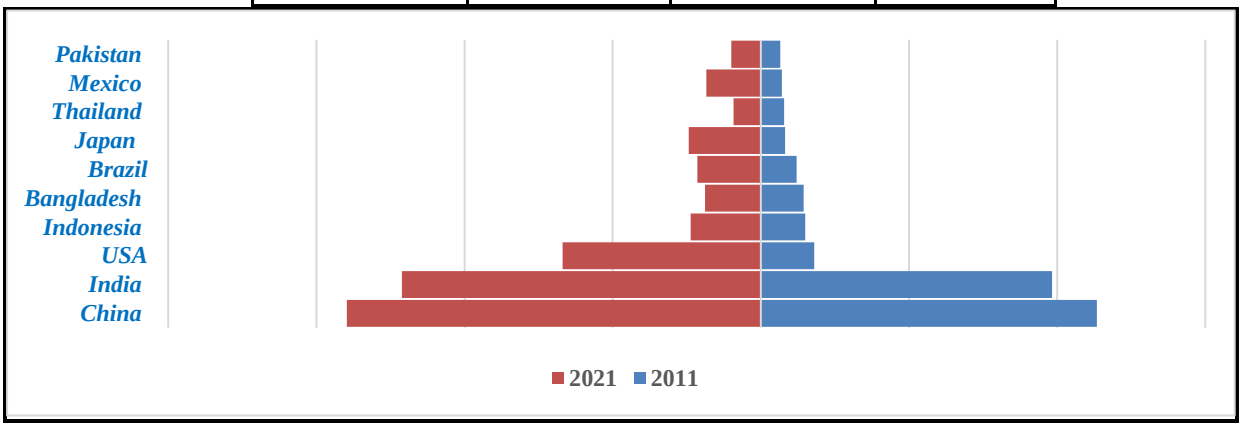

Fig. 3. Top (10) Countries Mortality Diabetes (20 – 79) year in (2011 & 2021)

The highest number mortality before age 60 was in Western Pacific (717400), followed by Middle East & North Africa (428600), then Africa (306000), the lowest was South & Central America (86700). The highest proportion of total mortality due to diabetes before age 60 was in Middle East & North Africa (24.5%), followed by North America & Caribbean (18.7%), the lowest was South East Asia (6.9%), table VII.

TABLE. VII. PROPORTION & NUMBER OF MORTALITY ADULTS FROM DIABETES BEFORE THE AGE OF (60) IN (2021) BY REGION

Region	No. of mortality before age 60 (thousand)	Proportion of total mortality due to diabetes before age 60 (%)
Western Pacific	717.4	15
Middle East & North Africa	428.6	24.5
Africa	306	8.9
South East Asia	301.2	6.9
North America & Caribbean	199.9	18.4
Europe	144.7	7.7
South & Central America	86.7	8

The highest mortality type 2 diabetes for the compression years (1990 & 2021) in OECD countries (192920), East Asian & Pacific (163099), the lowest Middle East & North Africa (21523) for (1990), but in (2019) the sequence was differ, South East Asia (447657), East Asian & Pacific (416474), and the same lowest region as in (1990), the highest percentage Eastern Mediterranean (243%), Middle East & North Africa (237%), South East Asia (228%), the lowest is Europe (43%), figure 4. For the income level, lower middle income (201232), upper middle income (165383), lower middle income (44413), Globally its increased by (144%), table VIII.

TABLE. VIII. MORTALITY FOR TYPE 2DIABETES FOR THE COMPRESSION YEARS (1990 & 2021) BY REGION

Region	1990	2021	%
OECD	192920	308535	60%
East Asian & Pacific	163099	416474	155%
South East Asia	136283	447657	228%
Americas	128561	290655	126%
Europe	122638	173324	43%
Western Pacific	112080	273883	144%
South Asia	99282	355039	126%

Latin America & Caribbean	82368	213642	159%
Sub – Saharian Africa	68653	159171	132%
Africa	68302	159309	133%
North America	47813	80290	68%
Eastern Mediterranean	34256	117655	243%
Middle East & North Africa	21523	72471	237%
Income level (World Bank)			
Lower Middle Income	201232	648973	222%
Upper Middle Income	194678	492277	153%
High Middle Income	165383	241870	46%
Low Middle Income	44413	88271	99%
World	606407	1479644	144%

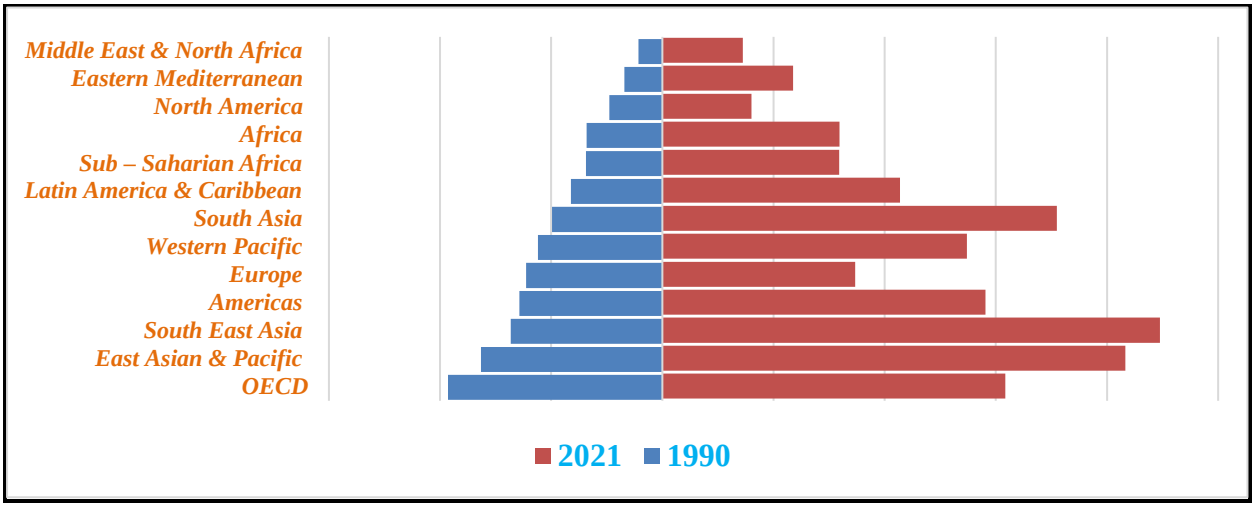

Fig. 4. Mortality For Type 2diabetes For the Compression Years (1990 & 2021) By Region

India ranked the highest country, followed by China, USA, for 1990 & 2021, Pakistan has the highest percentage (280%), India (259%), Indonesia (239%), the lowest Germany (6%), table IX and figure 5.

Table IX. Top (10) Countries Mortality type 2 Diabetes 1990 & 2021

Country	1990	2021	%
India	72125	258946	259%
China	64084	168388	163%
USA	43919	83409	67%
Indonesia	29125	98679	239%
Mexico	25670	72036	181%
Brazil	25556	62883	146%
Germany	20468	21707	6%
Italy	17472	21119	21%
Pakistan	11829	44961	280%
Bangladesh	10363	30639	196%

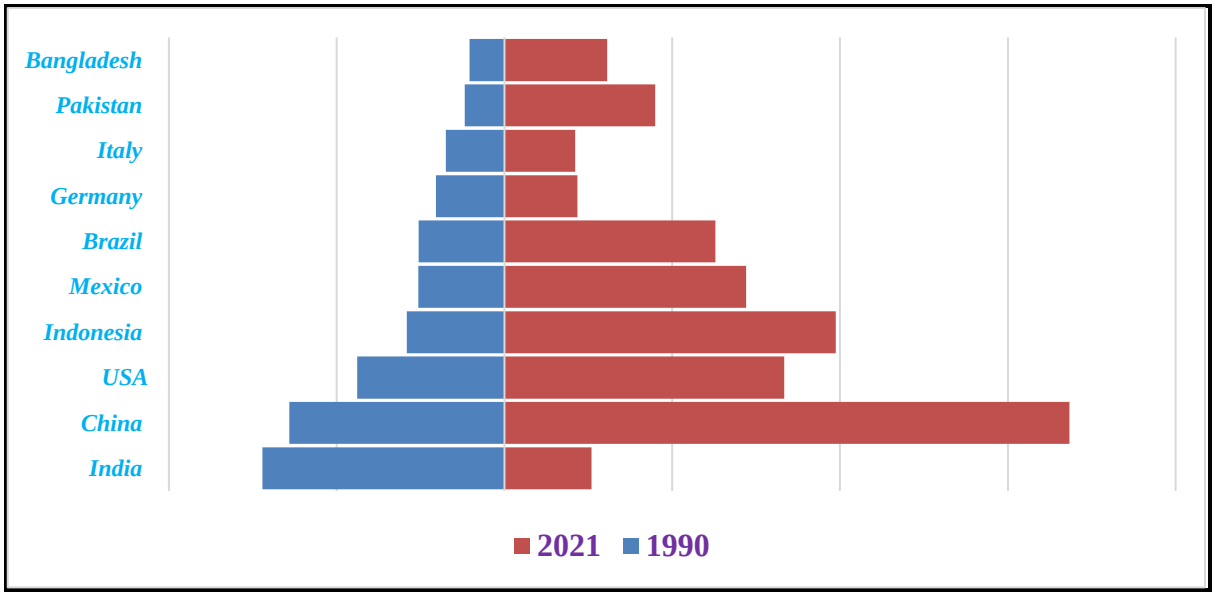

Fig. 5. Top (10) Countries Mortality type 2 Diabetes 1990 & 2021

4.2 Kids Diabetes Incidence

Children suffering from diabetes are still increasing and it is considered a health problem for people in the prime of life, the most prevalent regions are Europe, followed by Southeast Asia, then North America and the Caribbean, the least regions are the western Pacific, globally the number of children with diabetes was (108.3) per category (0 - 14) and number (149.5) per category (0 - 19), table X, and figure 6. The highest country was India (19194), followed by (15288), Canada is the lowest 2274) kids' case, table XI and figure 7.

TABLE. X. NUMBER OF KIDS DIABETES INCIDENCE CASES FOR THE AGE (0 – 14 & 0 – 19) IN (2021) BY REGION (1000 S)

Region	Number of cases (0 – 14)	Number of cases (0 – 19)
Europe	24.7	31.3
South East Asia	20.5	25.7
North America & Caribbean	18.7	24.4
Middle East & North Africa	18.1	25
South & Central America	9.5	12.3
Africa	7.7	19.7
Western Pacific	0.1	11.6
World	108.3	149.5

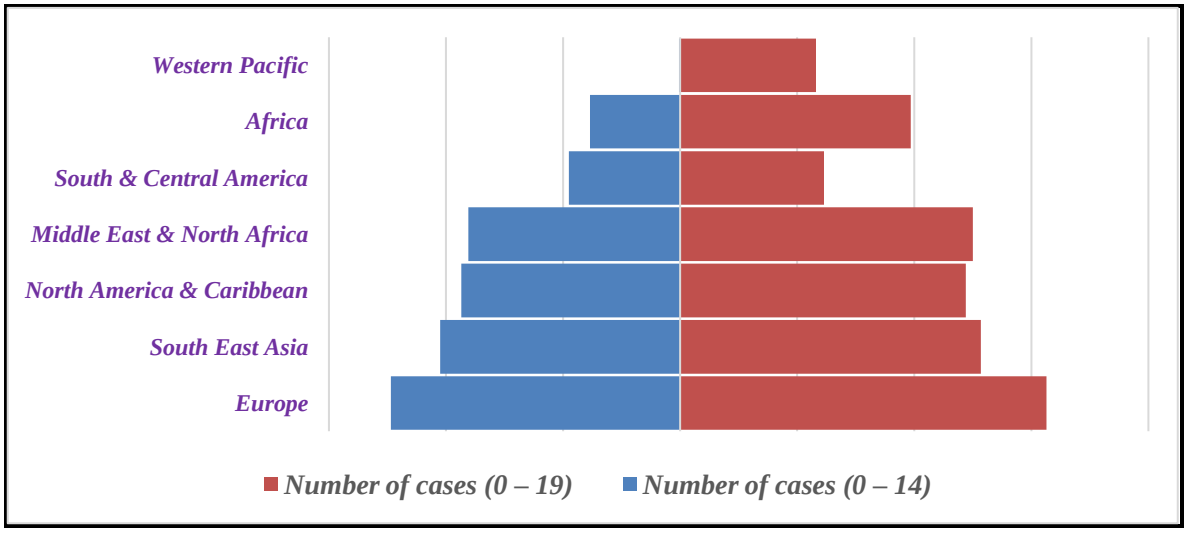

Fig. 6. Number of kids diabetes incidence cases

TABLE. XI. HIGHEST KIDS DIABETES INCIDENCE COUNTRIES 2021

Country	Highest kids diabetes incidence cases
India	19194
USA	15288
Brazil	7117
China	4900
Algeria	4874
Russia	3345
Germany	2845
UK	2713
Saudia Arabia	2680
Canda	2274

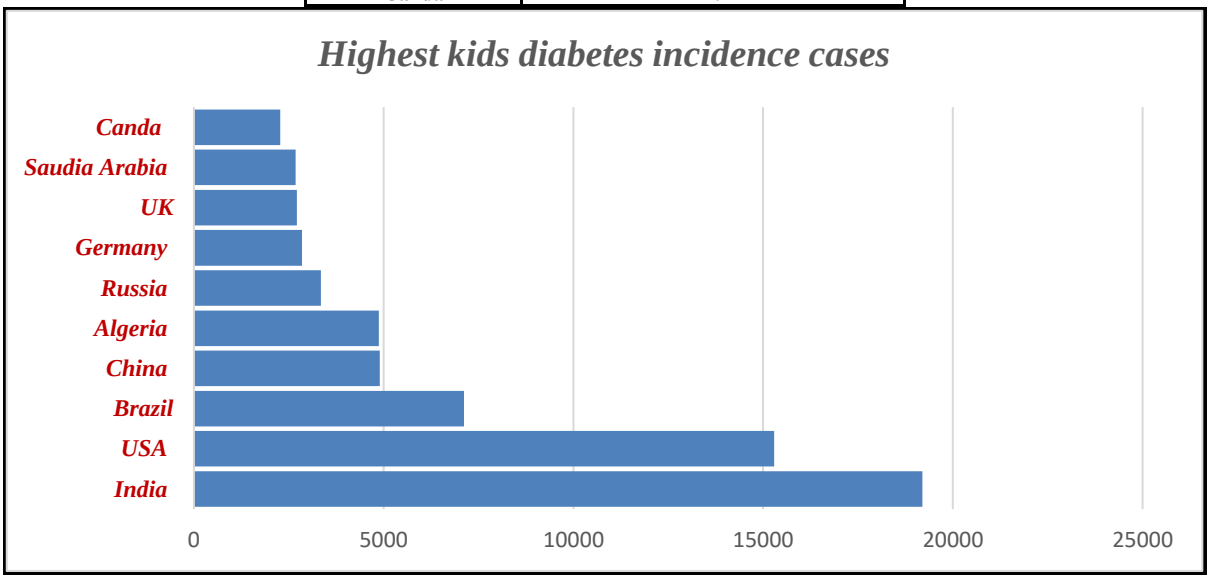

Fig. 7. Highest kids' diabetes incidence countries

4.3 Diabetes Case Study

A sample taken from 50 cases of patients being treated at the National Diabetes Center / Mustansiriya University, FBS and HbA1c results tests were taken. There are cases of response to the treatments taken and continuous follow-up of their health status. The paired sample t-test was performed using the SPSS statistical program, and it turned out that the value of the test for both cases (t = 7.73) and (t = 8.49), is significant (< 0.001) which indicates a high response by diabetics to the constant supervision by the National Center for Diabetes Treatment and Research, tables XII and XII.

TABLE.XII. FBS PAIRED SAMPLES TEST

Paired Samples Test									
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	d.f	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Before - After	33.94	31.04	25.11	25.11	42.76	7.73	49	< 0.001

Table. XIII. HbA1c Paired Samples Test

Paired Samples Test									
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	d.f	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Before - After	0.64	0.53	0.08	0.49	0.79	8.49	49	< 0.001

Diabetes is a common disease that affects different ages and classes, the seriousness of this disease comes from the possibility of many serious complications that may lead to death or permanent disabilities that are difficult to treat. Diabetes cannot be avoided, but there are some other factors that can be controlled, for example adopting a healthy lifestyle contributes to reducing the chances of developing the disease, so that it is possible to maintain weight within the normal limit, eat balanced foods, exercise regularly, quit smoking, and see a doctor if any symptoms of diabetes appear.

Regional analysis revealed contrasting trajectories: the Western Pacific already hosts the largest number of patients but is expected to grow only 5%, whereas Africa and the Middle East anticipate exponential increases. Mortality trends further reflect this imbalance North America and the Caribbean reported a 257% rise despite advanced healthcare systems, while Africa saw only 21% growth, though with higher mortality before age 60. Similarly, impaired glucose tolerance is stabilizing in Europe but more than doubling in Africa [2, 31].

Local data from Iraq (50 patients at the National Diabetes Center, Mustansiriya University) align with global trends: significant improvements in FBS and HbA1c under structured care highlight how targeted interventions can mitigate complications in high-risk populations. This dual-level approach linking global projections with regional disparities and a national case study provides a novel framework for understanding diabetes as both a worldwide epidemic and a locally mediated disease, where interventions must be adapted to demographic, economic, and healthcare contexts.

5. CONCLUSION

Diabetes remains a chronic disease with substantial health and psychological burdens, and while current treatments cannot cure the condition, structured follow-up and specialized care can significantly improve patient outcomes. The global analysis revealed that while prevalence is highest in developed countries, mortality is disproportionately concentrated in developing regions due to limited access to advanced diagnostics, therapies, and preventive services. In contrast, local data from Iraq showed significant improvements in clinical indicators, as confirmed by paired t-tests, demonstrating the effectiveness of consistent treatment and follow-up at specialized centers.

This dual analysis highlights the importance of bridging global epidemiological trends with local clinical evidence. For Iraq and similar developing countries, the findings suggest several policy priorities: expanding early screening to reduce undiagnosed cases, investing in specialized diabetes centers to improve treatment response, and integrating preventive strategies that address obesity, smoking, and environmental risk factors. Clinically, patient education, long-term follow-up, and access to affordable medications are essential to reducing complications and mortality. Together, these strategies can help mitigate the rising burden of diabetes while adapting global recommendations to local realities.

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Conflicts of Interest:

The authors report no conflicts of interest associated with this study.

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Authorship contribution statement

Safiya Saad Dhaif: Methodology, Formal analysis, Visualization. Supervision.
Sura Mouaid Abbas: Methodology, Writing - Original Draft, Visualization. Supervision, Project Administration, - Review & Editing. Investigation, Software,
Ashjan Mohammed Hussain: Methodology, Project Administration, Writing - Review & Editing
Tareq Hafdi abdtawfeeq: Conceptualization, Supervision, Project Administration.
Ayat Majeed Zeadan: Methodology, Visualization, Data Curation.
Hamza Jabbar Jebour: Methodology, Formal analysis, Software.
Nathier A. Ibrahim: Conceptualization, Methodology, Formal analysis, Writing - Original Draft, Visualization, Funding Acquisition, Data Curation, Software.

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