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RESEARCH ARTICLE

GLYCAEMIC CONTROL AMONG SAUDI PATIENTS WITH TYPE 2 DIABETES MELLITUS AT FIRST TIME REGISTRY IN RAQEB RECORDS FROM 2018-2022

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Abstract

Background: Diabetes Mellitus (DM) is a major risk factor for many complications and glycaemic control prevents and delays such complications. The Raqeb registry aims toimprove diabetic patients'control of their diabetes by giving them glucometers.

Objective: This study aims to determine the prevalence of type 2 diabetes (T2DM) glycaemic control in all regions of Saudi Arabia using Raqeb data, as well as outline the factors associated with uncontrolled T2DM.

Methods: This paper conducted a registry-based cross-sectional study among all patients with T2DM who registered in Raqeb from October 16, 2018, to July 17, 2022. According to the American Diabetes Association, for non-pregnant adults, HbA1c can be used to assess glycaemic control according to the HbA1c target of < 7% (control DM) and ≥7 (uncontrolled DM). To identify glycaemic control determinants, the present study used multivariate logistic regression analysis, while SPSS v26 software was used for data entry and analysis.

Results: In the study, the mean level of HbA1c of the patients was 8.4 (SD1.7) and approximately 86% of the patients had uncontrolled diabetes mellitus (HbA1c ≥ 7%). Multivariate analysis revealed that being over 45 years old, using hypoglycaemic agents (OHA) and insulin, being followed up in a diabetic centre and being from the Western, Southern or Northern regions were all significant predictors of poor glycaemic control. Meanwhile, the female gender and OHA treatment were linked to a lower risk of poor glycaemic control.

Conclusion: Using data from Saudi Arabia's Raqeb registry of T2DM patients, this different level of care database analysis over a five-year period revealed uncontrolled DM. An increased risk of uncontrolled DM in T2DM patients was seen in those over the age of 45 years and patients using OHA and insulin treatment, as well as people from the Western, Southern or Northern regions of Saudi Arabia.

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Introduction:-

Diabetes was the ninth-leading cause of death in 2019, accounting for 1.5 million deaths globally [1]. Diabetes is a major risk factor for many other diseases, including cardiovascular disease, stroke, kidney disease and blindness. Type 2 diabetes (T2DM) accounts for more than 90% of cases of diabetes mellitus [2]. Haemoglobin A1c (HbA1c) measures the average glycaemic level over three months, which is significant given the importance of achieving tight glycaemic control to reduce mortality and morbidity in diabetic patients. The American Diabetes Association (ADA) recommends an HbA1c target of <7.0% for non-pregnant adults with diabetes [3]. However, poor glycaemic control is prevalent among patients with T2DM[4].

Approximately 537 million adults (20-79 years old) worldwide are diabetic [2], whileprevalence is high in the Middle East and North Africa (MENA) region[5]. According to the International Diabetes Federation (IDF), in the 20-79 yearsage group, diabetes prevalence is 10.5% globally and 18.1% in the MENA region [5]. The prevalence of poor glycaemic control among patients with T2DM has reached 93% in Egypt, 60.7% in Ethiopia, 61.3% in Indonesia, 76.6% in Iraq and 47.3% in Brazil [4]. A review article showed that appropriate glycaemic control varies from 15% to 41% in the Arabian Gulf countries [6].

In terms of the highest diabetes-related expenditure among MENA countries, the Kingdom of Saudi Arabia (KSA) is the fourth-rankedcountry[2]. According to the IDF, in 2021, the prevalence of diabetes was 18.7% (4.3 million) in adults aged 20 to 79 years[2]. A study done in a tertiary care centre at King Abdulaziz University Hospital (KAUH) in Jeddah and King Khaled University Hospital in Riyadh showed that T2DM had poor control of 68.3 and 43.1% of patients, respectively [7,8]. Meanwhile, another study conducted in 2017 in Hofuf, Riyadh and Jeddah showed that only 24.1% of T2DM patients met the recommended HbA1c level of less than 7% [9]. Moreover, studies done in diabetic centres in Tabuk, Jeddah and Aseer showed poor glycaemic control in 74.9%, 70.2%, and 92.9% of patients, respectively [9,10]. According to a study conducted at diabetes centres in the cities of Riyadh, Hofuf and Jeddah; being older than 60, having diabetes for a longer period, living in a remote area, having a low household income, eating few fruits and vegetables, not getting enough exercise, not knowing what HbA1c is, having a high waist-hip ratio, not taking medications as prescribed, and using injectable treatments were all independent predictors of poor glycaemic control [11].Concerning age factors, another study at King Khaled University Hospital in Riyadh supported the above finding, reporting that patients older than 65 had uncontrolled diabetes compared to the younger participants; additionally, those with hypertension and dyslipidaemiawere less likely to have controlled diabetes[8]. When compared to insulin-only treatments, the use of combined insulin and tablet treatments was associated with a higher risk of poor glycaemic control [10,12]. One study set in a primary healthcare setting in Jazzanaimed to assess the relationship between vitamin D deficiency and T2DM [13]. Some studies have used fasting blood glucose instead of HbA1c, which is considered an inaccurate measurement [14,15].

In the context of Saudi Arabia, some studies have been conducted on the risk factors associated with glycaemic control, many of which use fasting blood sugar to measure this, although a few use HbA1c. Most of this research was done at a single hospital or centre in a small geographic area. In primary healthcare, this paper was unable to identify any studies that aimed to estimate the prevalence of uncontrolled T2DM and none of the existing research used the Raqeb Registry. This study aims to provide the prevalence of T2DM glycaemic control in all regions of Saudi Arabia and determine the factors associated with uncontrolled T2DM.

Methods:-

Study design and data collection

This registry-based, analytical cross-sectional study aims to determine the prevalence of glycaemic control and its risk factors among T2DM adult patients in all regions of Saudi Arabia utilising Raqeb data at different levels of care from October 16, 2018, to July 17, 2022.

Study Setting

According to estimates from the General Authority for Statistics (GOSI), the total population of the KSA reached 34.1 million in 2021 (mid-year). The present study uses the Raqeb data registry, whichis an electronic system established in 2018 and implemented in all Saudi regions. This registry not only aims to register all patients with all types of diabetes (including type 1 DM, type 2 DM and gestational diabetes) who want to get a glucometer device

but also includes the nearest HbA1c, mode of treatment and institute where the patient is followed up. DM glycaemic control is measured according to the level of glycated haemoglobin A1c (HbA1c). It covered all 20 regions of Saudi Arabia, includingthe Central Region (Riyadh, Qasim), Eastern Region (Eastern Region, Hafer, Alhasa), Western Region (Mecca, Medina, Jeddah, Qunfutha, Taif), Southern Region (Asir, Beshah, Bahah,Najran, Jizan) and Northern Region (Tabuk, Jouf, Hail, Al Hudud ash Shamaliyah, Al Qurayyat).

Study population
The study populationis all T2DM patients who were registered in the RaqebRegistry between October 16, 2018, and July 17, 2022, totalling 229,238 patients.

InclusionCriteria:
All patients aged 18 and above withT2DM.

ExclusionCriteria:
Patients with gestational diabetes and type1 diabetes.

Sampling technique and Data collection
The data was extracted from the Raqeb Registry into an Excel spreadsheet and then the included variables were coded. Glycaemic control level is the outcome variable and the socio-demographic and clinical variables are the risk factors for poor glycaemic control among T2DM patients in Saudi Arabia.

Variables
Variables include gender, age (which was later categorised into four groups, ≤44, 45-54, 55-64, ≥ 65), residence (regionand province), mode of treatment (insulin-only; Oral HypoglycaemicAgents (OHA); OHA plusinsulin)and the type of institute where the patient was followed up (hospital, diabetic centre, health centre). The HbA1c results were used to classify the glycaemic control level:

1. controlled diabetes (in non-pregnant adults) was defined as HbA1c <7%
2. uncontrolled diabetes (in non-pregnant adults)was defined as HbA1c ≥7%

Data analysis
The present study used Microsoft Excel and SPSS (version 23) for coding, cleaning and data analysis. For categorical variables, the data were summarised using frequency and percentages; while for continuous variables, the mean, median, standard deviation (SD), and range were used. As mentioned above, this study divided glycaemic control into two categories, controlled (HbA1c <7%) and uncontrolled (≥7%). To identify the factors associated with uncontrolled diabetes in the study sample, the researchers conducted a chi-square test with a significance level of p-value <0.05. The variables identified as significant were then included in a multivariate logistic regression to detect possible risk factors for poor glycaemic control. The researchers calculated the odds ratios (ORs) and 95% confidence intervals (CIs).

Ethical declaration
Before beginning, this study was approved by the Research Ethics Committee of the Ministry of Health's General Directorate of Research and Study (GDRS-MOH) in Saudi Arabia (IRB log No: 23-16 E). Since this study used data from patients who have been diagnosed with diabetes, confidentiality was the primary ethical concern. The present study ensured that no personal information was disclosed and that the data would be used only for the purposes of this research.

Results:-

This study included a total of 229,238 records of T2DM patients aged ≥18 years who were registered on the Raqebregistrybetween October 16, 2018, and July 17, 2022. Among these, 52.6% were male and 47.4% were female, with mean (±SD) age of 57.9 ± 13.6 years. The majority of the patients in this study (32.3%) were between 55 and 64 years old and 30.2% were above the age of 65. Most patients (57.2%) were receiving OHA medication, followed by a combination of both insulin and OHA (25.7%) or insulin-only (17.1%). Meanwhile, 64.4% of patients were being followed-up in primary healthcare centres, while 29.1% were followed-up in hospitals. The participants' mean (SD) HbA1c % was 8.4 (1.7), the median was 8.0, and the highest reading was 20 (see Table 1).

Table 1:- Demographic and clinical characteristics (n 229,238).

Variables	HbA1c Mean (SD)	Frequency	Percent %
Age mean ± SD 57.92 ±13.6			
Age in years			
≤44	8.4 (±1.8)	38541	16.8
45-54	8.4 (±1.7)	47426	20.7
55-64	8.4 (±1.6)	74150	32.3
≥65	8.3 (±1.6)	69121	30.2
Gender			
Male	8.39 (±1.7)	120545	52.6
Female	8.38 (±1.7)	108693	47.4
HbA1c mean ±SD 8.4 ±1.7			
Glycemic Control			
<7 % (Controlled DM)	6.2 (±0.5)	31752	13.9
≥7 % (Uncontrolled DM)	8.7 (±1.2)	197486	86.1
Current treatment			
Insulin Only	8.7 (±1.7)	39231	17.1
Oral	8.1 (1.6)	131160	57.2
Combination of both	8.8 (±1.7)	58847	25.7
level of care (n)			
primary Health Care Center(1059)	8.3 (±1.7)	147634	64.4
Hospital (101)	8.5 (±1.6)	66809	29.1
Diabetic Center (11)	8.9 (±1.5)	14795	6.5

All the patients were Saudi nationals from all 20 health regions and many patients in all regions showed low control of their DM, as in Najran it was 35.1% and 1.7% in Hafer Al-batin (see Table 2).

Table 2:- Distribution of patients according to regions by level of glycemic control.

		Glycemic Control				Total	
		Controlled DM <7 %		**UncontrolledDM ≥7 %**			**percentage**
Regions	**Riyadh**	5448	22.4%	18829	77.6%	24277	10.6
	Eastern Province	5882	21.1%	21972	78.9%	27854	12.2
	Makkah	1665	15.2%	9320	84.8%	10985	4.8
	Qasim	3544	13.9%	21916	86.1%	25460	11.1
	Tabuk	420	9.6%	3940	90.4%	4360	1.9
	Bahah	1248	14.2%	7565	85.8%	8813	3.8
	Jawf	719	10.0%	6469	90.0%	7188	3.1
	Al-Shamal Borders	276	5.0%	5195	95.0%	5471	2.4
	Madinah	2088	9.5%	19891	90.5%	21979	9.6
	Jizan	1248	7.5%	15383	92.5%	16631	7.3
	Hail	11	15.9%	58	84.1%	69	.0
	Asir	1777	10.1%	15736	89.9%	17513	7.6
	Najran	803	35.1%	1482	64.9%	2285	1.0
	Ahsa	3186	18.1%	14376	81.9%	17562	7.7
	Taif	817	12.4%	5784	87.6%	6601	2.9
	Goriat	366	8.0%	4230	92.0%	4596	2.0
	Gonfuda	395	10.7%	3292	89.3%	3687	1.6
	Jeddah	1171	10.1%	10433	89.9%	11604	5.1
	Hafr Al-Batin	100	1.7%	5667	98.3%	5767	2.5
	Bisha	588	9.0%	5948	91.0%	6536	2.9
Total		31752	13.9%	197486	86.1%	229238	
		13.9%		86.1%		100.0%	

Achievement of glycaemic target

More than 86% of the study participants had not achievedglycaemic control. As illustrated in Table 1, 86.5% of male patients and 85.7% of female patientshad HbA1c levels ≥ 7%. The study indicated that just 13.5% of males and 14.7% of females had good control of their HbA1c levels, while the percentage of uncontrolled T2DM was similar across the different age groups. Compared to individuals using OHA exclusively (81.9%), the majority of those using injectable medications or combined injectable and OHAs (91.5% and 92.1%, respectively) had uncontrolled DM.In terms of settings, 85.5% of patients followed up in a primary health centre (PHC), 86.9% of patients followed up in hospitals and 95.2% of patients under a diabetic centre had uncontrolled DM.Patients attending primary care clinics had a mean HbA1c of 8.3% compared to 8.9% of those attending a diabeticcentre. During the years from 2018 to 2022, the percentage of patients with uncontrolled DM decreased slightly from 88.7% to 85.1%. The percentage of controlled and uncontrolled T2DM patients varied among different health regions in Saudi Arabia with the lowest percentage of uncontrolled DM (77.6%) seen in Riyadh health regions.

Factors associated with poor glycaemic control among study participants

Factors that were significantly associated with uncontrolled DM (Table 3) included the age of the patient. The results for patients 45-54 years old were [OR= 1.10,95%CI (1.06-1.15), P <0.001); rising for the following age groups including those 55-64 years at [OR=1.18, 95%CI (1.14-1.22), P<0.001)]; for≥ 65 years [OR=1.20, 95%CI (1.16-1.24), P<0.001)]. Moreover, being female [OR = 0.93, 95% CI (0.91-0.96), P<0.001)] and being treated with OHA [OR = 0.42, 95% CI (0.40-0.43), P<0.001) protected against uncontrolled DM, while a combination of insulin and OHA [OR = 1.07, 95% CI (1.05-1.10), p<0.001)] was significantly associated with uncontrolled DM. In addition, the level of care also significantly has a different effect; being treated in a specialised diabetic centre [(OR=2.97, 95%CI (2.4-3.21), P<0.001)] is significantly associated with uncontrolled DM, while follow-up in a PHC [OR= 0.85, 95%CI (0.82-0.87), P<0.001)] is protective against uncontrolled DM. Based on the years analysis, although the results show that the year's period is protective, there is an overlap in the 95% CI that makes the results not statistically significant. Moreover, Table 4 shows that being from the Western Region [OR = 1.75, 95% CI (1.69–1.82)], Southern Region [OR = 1.80, 95% CI (1.73–1.86)] or Northern Region [OR = 2.45, 95% CI (2.32–2.584)] is also linked to uncontrolled DM.

Table 3:- Univariate logistic regression analysis of factors associated with glycemic control.

Variable	Category	Glycemic control (HbA1c)		BivariateAnalysis	
		Controlled DM (< 7%) n(%)	**Uncontrolled (≥ 7%) n(%)**	**COR (95% CI)**	**P-value**
Age group	≤44	5943 (15.4%)	32598 (84.6%)	1	-
	45-54	6727 (14.2%)	40699 (85.8%)	1.10 (1.06-1.15)	<0.001*
	55-64	9943 (13.4%)	64207 (86.6%)	1.18(1.14-1.22)	<0.001*
	≥ 65	9139 (13.2%)	59982 (86.8%)	1.20 (1.16-1.24)	<0.001*
Gender	Male	16234 (13.5%)	104311(86.5%)	1	-
	Female	15518 (14.3%)	93175 (85.7%)	0.93 (0.91-0.96)	<0.001*
Mode of therapy	Insulin Only	3319 (8.5%)	35912 (91.5%)	1	-
	Oral-hypoglycemic agents	23767 (18.1%)	107393 (81.9%)	0.42 (0.40-0.43)	<0.001*
	OHA & Insulin	4666 (7.9%)	54181 (92.1%)	1.07 (1.02-1.12)	0.003*
Level of care	Hospital	8739 (13.1%)	58070 (86.9%)	1	-
	Diabetic cener	714 (4.8%)	14081 (95.2%)	2.97 (2.74-3.21)	<0.001*
	Health Center	22299 (15.1%)	125335 (85.5%)	0.85 (0.82-0.87)	<0.001*
Years	2018	1648 (11.3%)	12891 (88.7%)	1	-
	2019	16792 (14.3%)	100898 (85.7%)	0.77 (0.73-0.81)	<0.001*
	2020	6351(13.1%)	42123 (86.9%)	0.85(0.8-.89)	<0.001*
	2021	5369 (14.2%)	32473 (85.8%)	0.77(0.73-0.82))	<0.001*
	2022	1592 (14.9%)	9101 (85.1%)	0.73(0.68-0.79)	<0.001*

Table 4:-Univariate and Multivariate logistic regression analysis for regions according to glycemic control.

	Frequency	Control	uncontrolled	COR	95% C. I	AOR	95% C. I	P-value
Central Region	49737 (22%)	8992 (18.1%	40745 (81.9%	1	-			
Eastern Region	51183 (22%)	9168 (17.9%)	42015 (82.1%)	1.01	0.98-1.04	1.024	0.99-1.06	0.161
Western Region	54856 (24%)	6136 (11.2%)	48720 (88.8%)	1.75	1.69-1.82	1.852	1.78-1.93	<0.001*
Southern Region	51778 (23%)	5664 (10.9%)	46114 (89.1%)	1.80	1.73-1.86	1.684	1.62-1.75	<0.001*
Northern Region	21684 (9%)	1792(8.3%)	19892(91.7%)	2.45	2.32-2.584	1.980	1.87-2.10	<0.001*
Total	229238							

Predictors of poor glycaemic control among T2DM patients reported in the RaqebRegistry

The results of the multivariate logistic regression (table 5) showed the following:

Compared to age groups less than 40 years old, the odds ratios (ORs) of uncontrolled DM for age groups 45–54 years, 55–64 years and ≥ 65 years, were [OR = 1.18, 95%CI (1.14, 1.23), P = <0.001], [OR = 1.23, 95%CI (1.19, 1.27), P = <0.001], and [OR = 1.20, 95%CI (1.16, 1.25), P = <0.001], respectively. The odds of uncontrolled T2DM were 0.91 times [OR = 0.91, 95%CI (0.89, 0.93), P = <0.001] among female patients compared to male patients. Moreover, patients on OHAs have 55% [OR = 0.45, 95% CI (0.43, 0.47), P = 0.001] lower odds of having uncontrolled diabetes compared to patients on insulin-only, and patients on combined OHAs and insulin have 14% [OR = 1.14, 95% CI (1.09, 1.19), P = 0.003] higher odds of having uncontrolled diabetes compared to patients on insulin only. Patients followed up in PHCs have 16% [OR = 1.16, 95%CI (1.13, 1.29), P = 0.001] higher odds of having uncontrolled diabetes, while patients followedup in diabetic centres have almost three times [OR = 2.45, 95%CI (2.24, 2.67), P = 0.001] higher odds of having uncontrolled diabetes compared to patients followed up in hospitals.Meanwhile, patients from the Southern, Western and Northern regions have significantly higher odds of uncontrolled diabetes compared to patients from the Central region; the ORs of [OR = 1.68, 95% CI (1.62, 1.75), P = 0.001] for the Southern region, [OR = 1.85, 95% CI (1.78, 1.93), P = 0.001] for the Western region and [OR = 1.98, 95% CI (1.87, 2.10), P = 0.001] for the Northern region indicate that patients from these regions have 68%, 85% and 198%, respectively higher odds of uncontrolled diabetes compared to patients from the Central region.

Table 5:- Multivariate logistic regressionanalysis of factors associated with glycemic control.

Variable		Multivariate Analysis	
		AOR (95% CI)	**P-value**
Age group	≤44	1	-
	45-54	1.18 (1.14–1.23)	<0.001*
	55-64	1.23 (1.19–1.27)	<0.001*
	≥ 65	1.20 (1.16–1.25)	<0.001*
Gender	Male	1	-
	Female	0.91 (0.89-0.93	<0.001*
Mode of therapy	Insulin Only	1	-
	Oral-hypoglycemic agents	0.45 (0.43–0.47)	<0.001*
	OHA & Insulin	1.14 (1.09–1.19	<0.001*
Level of care	Hospital	1	-
	Diabetic cener	2.45 (2.24–2.67)	<0.001*
	Health Center	1.16 (1.13-2.00)	<0.001*
Years	2018		
	2019	0.95 (0.89-1.00)	0.053
	2020	1.09 (1.03-1.16)	0.003*
	2021	0.99 (0.93-1.05)	0.735
	2022	1.01 (0.94-1.09)	0.777

Discussion:-

The current study used data from the Saudi-basedRaqeb registry of T2DM patients treated at different levels of care and the researchers examined the level of glycaemic control and the factors that could influence it among patients from all 20 regions of Saudi Arabia. One crucial aspect of managing T2DM is achieving and maintaining glycaemic control, which is often assessed by the glycated haemoglobin (HbA1c) level. To reduce the risk of microvascular and macrovascular complications in patients with T2DM, an HbA1c target of less than 7.0% is widely recommended. However, many patients fail to achieve this target, leading to increased morbidity and mortality. The results of this paper showed uncontrolled T2DM in mostof the study population since only 13.9 % achieved the HbA1c target (<7%).

The findings of this study are consistent with other studies. In both the United States (US) and European countries, a significant proportion of individuals with T2DM failed to achieve the target HbA1c of <7.0%. A retrospective cohort in the US found that only 53.2% of patients with T2DM achieved HbA1c <7.0%[16]. Similarly, a cross-sectional study analysing data from eight European countries reported that only 54.9% of patients achieved this target[17]. In China, a study revealed that only 22.9% of patients achieved HbA1c of <7.0%[18] and another study conducted in Gulf Cooperation Council(GCC)countries found that 54% to 88.8% of T2DM patients had uncontrolled diabetes[19].

This paper found thatolder patients were more likely than younger age groups to have uncontrolled DM. Each one-year increase in age resulted in a 10% to 18% increase in the odds of having uncontrolled DM. These findings suggest that age is a significant predictor of glycaemic control among patients with T2DM, with older patients being at higher risk of uncontrolled diabetes. This may be due to various factors, including age-related changes in metabolism and insulin sensitivity, an increased prevalence of comorbidities and a decreased ability to adhere to self-management practices [20]. Similarly, a study conducted in Ethiopia found that older age was associated with poorer glycaemic control among patients with T2DM [21,22], with similar results reported in studiesbasedinNorthern California, USA [23].

The present study found that men were less likely than women to have uncontrolled DM. A possible justification for such gender disparity could be associated with females' lower physical activity levels of females plus their increased likelihood of consuming sweet foods with a high glycaemic index. The uncontrolled T2DM prevalence of men was slightly higher than that of women. This paper's findings are supported by research from China and Iran that was consistent with these findings [18,24]. However, the research found no gender differences in treatment achievement of glycaemic goals with T2DM[25].

This paper also found that patients receiving care in primary care settings had better glycaemic control than those receiving care in a diabetic centre. Patients who are followed up in health centres have lower odds of having uncontrolled diabetes compared to those followedup in hospitals, while patients followedup in diabetic centres have almost three times higher odds of having uncontrolled diabetes. Both adequate and excellent levels of glycaemic control were linked to continuity of care, which tends to be more prevalent in primary health care [26]. Other studies have also found that compared to hospitals, primary healthcare offered diabetes patients higher-quality care [27].

The current study suggested that there was a significant association between the treatment regimen and glycaemic control among patients with T2DM. A study conducted in China found that patients on oral hypoglycaemic agents (OHAs) had lower odds of having uncontrolled diabetes compared to patients on insulin. However, patients on combined OHAs and insulin had higher odds of having uncontrolled diabetes compared to patients on insulin only [28]. The use of oral agents alone decreased with diabetes duration. Corresponding increases inOral Antidiabetic Drugs OAD plus insulin use were also observed among individuals with a diabetes duration of ≥10 years who were more likely to use a combination of OADs and insulin.

Limitations

Due to the nature of the study, data were collected retrospectively from the existing Raqeb registry of DM patients. This registry was not developed and implemented for research purposes, hence the type and number of included variables. Therefore, some information may be limited and others could be missing. Although the present study is national and covers all 20 regions of Saudi Arabia and is thus generalisable; many variables that could affect the level of glycaemic control are not included in the registry, such as lifestyle, other socioeconomic variables and knowledge about DM. Other confounding factors, such as diet, physical activity level and adherence to treatment

protocol were not investigated in this study. All these factors are likely to influence glycaemic control. The use of secondary data is associated with inherent limitations because some variables may not be included in the data. This study lacked detailed data on some aspects of patient management at the outset; for example, changes in drug management could account for the HbA1c improvements. Such specifics would be useful to evaluate in future research.

Farther study

Further research is needed to investigate the underlying factors contributing to these differences and develop effective interventions to improve glycaemic control in both males and females with T2DM.

Conclusion:-

Using data from Saudi Arabia's Raqeb registry of T2DM patients, these different levels of care database analysis over a five-year period revealed uncontrolled DMwith only 13.9% of the study population achieving the appropriate HbA1c target (<7%). This study also found that both female gender and being on OHA-only treatment were associated with better glycaemic control. An increased risk of uncontrolled DM in T2DM patients was seen in patients over the age of 45 and those who used combined oralhypoglycaemic agents (OHA) and insulin treatment, as well as those fromthe Western, Southern or Northern Region. To overcome inadequate glycaemic control, the present study's findings highlight the importance of improving diabetes care practices in Saudi Arabia, including considerations for disease monitoring as well as self-management strategies such as the development of an ideal lifestyle and treatment adherence.

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