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Diabetes Demographics and Risk Factors in Shahat City, Libya

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Abstract

Background: Diabetes mellitus is an important public health matter worldwide. It is a set of metabolic disorders that lead to elevated blood sugar levels for a long span.

Materials and methods: This is a retrospective study implemented at the diabetic center of Shahat City. It studied all enrolled cases from September 2013 to the end of 2023, and all information was obtained about age, gender, age at the start of the disease, and other personal information about cases, in addition to whether the patient was type 1 or 2 from records of the center. The subjects of the study were all the patients who registered in the Diabetic Shahat Center the study was conducted in 2024. 2713 out of 3778 whose complete data were included and those incompletes were excluded.

Results: The study showed diabetes in Shahat City distribution of diabetic patients, with 56.6% females and the highest age range being 41-60. Most cases were type 2 diabetic patients (90%).

Conclusions: In terms of gender, there were slightly more females than males. In addition, this study proved that age is an important determinant in the occurrence of DM and increases the likelihood of getting DM with increased age

Keywords: Diabetes mellitus, insulin, Shahat City, Libya.

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التركيبة السكانية وعوامل الخطر لمرض السكري في مدينة شحات، ليبيا

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الملخص

الخلفية :يعتبر داء السكري من القضايا الصحية العامة المهمة على مستوى العالم. وهو مجموعة من الاضطرابات الأيضية التي تؤدي إلى ارتفاع مستويات السكر في الدم لفترة طويلة.

المواد والأساليب :هذه دراسة استرجاعية تم تنفيذها في مركز السكري بمدينة شحات. درست جميع الحالات المسجلة من سبتمبر 2013 حتى نهاية 2023، وتم الحصول على جميع المعلومات حول العمر، الجنس، العمر عند بدء المرض، ومعلومات شخصية أخرى عن الحالات، بالإضافة إلى ما إذا كان المريض من النوع 1 أو 2 من سجلات المركز. مواضيع الدراسة كانت جميع المرضى الذين سجلوا في مركز السكري بشحات، وتم إجراء الدراسة في عام 2024. تم تضمين 2713 من أصل 3778 حالة كانت بياناتها كاملة، وتم استبعاد الحالات غير المكتملة.

النتائج :أظهرت الدراسة توزيع مرضى السكري في مدينة شحات، حيث كانت 56.6% من الإناث، وكانت أعلى فئة عمرية هي 41–60 سنة. وكانت معظم الحالات من مرضى السكري من النوع 2.(90%)

الاستنتاجات :من حيث الجنس، كان هناك عدد قليل من الإناث أكثر من الذكور. كما أثبتت هذه الدراسة أن العمر هو عامل حاسم في حدوث داء السكري، ويزيد من احتمالية الإصابة به مع تقدم العمر.

الكلمات المفتاحية :داء السكري، الأنسولين، مدينة شحات، ليبيا.

Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood sugar levels (hyperglycemia) due to either insufficient insulin production, ineffective use of insulin, or both.

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This condition can lead to serious health complications if not managed effectively. Diabetes is generally classified into three main types; Type 1 DM, known as Insulin-dependent diabetes mellitus (IDDM), ensues from the inability of the pancreas to produce enough insulin, type 2 DM (Non-insulin-dependent diabetes mellitus) begins with insulin resistance, a condition in which cells fail to respond to insulin properly and gestational diabetes is the third main form, and occurs when pregnant women without a previous history of diabetes develop high blood sugar levels (Alanazi, et al., 2017).

This study aimed to analyze the demographic and clinical characteristics of diabetes patients in Shahat, Libya, focusing on age, gender, diabetes type, and fasting blood sugar levels. It sought to identify patterns and correlations to inform better diabetes management and prevention strategies in the region.

Methodology

Materials and methods:

This study utilized comprehensive diabetes records from the Diabetes Center in Shahat City, Libya, to explore the relationship between diabetes mellitus and various factors such as age, gender, the age that started of disease, and diabetes type (Type 1 or Type 2). The research spanned from September 2013 to the end of 2023, allowing for an in-depth analysis of patient data over a significant period.

Data were collected from medical records, which included demographic information, clinical histories, and laboratory results. We categorized patients based on their age groups, gender, and the age at which they were diagnosed with diabetes. Additionally, we distinguished between Type 1 and Type 2 diabetes to assess how these classifications influenced patient outcomes.

By analyzing this data, the study aimed to identify patterns and correlations that could inform better management and prevention strategies for diabetes in the region. The findings will contribute to a deeper understanding of how demographic factors affect diabetes spread and treatment in the Libyan population.

Statistical analysis:

In this research, we conducted a comprehensive statistical analysis using data obtained from the Diabetes Center records. Both descriptive and inferential statistical methods were employed to

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analyze the data, providing a robust framework for understanding the relationships between diabetes and various demographic factors. Descriptive statistics were used to summarize the characteristics of the study population, including means, medians, frequencies, and percentages. This allowed for an initial overview of the data and helped in identifying trends and patterns. We utilized SPSS version 21 to create tables and graphical representations, such as bar charts and pie charts, to visually convey the findings.

Inferential statistics were applied to test hypotheses and determine the significance of relationships between variables, such as age, gender, and diabetes type. The results of these analyses were interpreted to provide insights into the epidemiology of diabetes in the Shahat region. Overall, the use of SPSS facilitated a systematic approach to data analysis, enhancing the reliability and validity of the study's conclusions.

Ethical approval

The study did not require a review board approval. Because this study does not involve any risk to participants and the participant's name is anonymous (no need to write the participant's name). Furthermore, all the data have already been obtained from the participants in a cooperative way.

Results

The results obtained from the Diabetes Center in Shahat provide significant insights into the demographics and clinical characteristics of patients with diabetes.

Table 1: Distribution of cases according to gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	1178	43.4	43.4	43.4
Female	1535	56.6	56.6	100.0
Total	2713	100.0	100.0	

Table 1 shows the distribution of diabetic cases the data indicates a notable gender disparity in diabetes occurrence, with females being more affected than males. This trend could be attributed to various factors, including differences in lifestyle, hormonal influences, and access to healthcare services.

http://www.doi.org/10.62341/ragd1834

Table 2: Distribution of cases according to the age period

Age period	Frequency	Percent	Valid Percent	Cumulative Percent
0-10 years	3	.1	.1	.1
11-20 years	24	.9	.9	1.0
21-40 years	113	4.2	4.2	5.2
41-60 years	891	32.8	32.8	38.0
61-80 years	1365	50.3	50.3	88.3
81-110 years	317	11.7	11.7	100.0
Total	2713	100.0	100.0	

The data presented in Table 2 illustrates that the incidence of diabetes increases with age, peaking in the 61-80 years age group. This pattern aligns with existing literature that identifies age as a significant risk factor for diabetes, likely due to the cumulative effects of lifestyle choices, metabolic changes, and the increased likelihood of comorbidities in older populations.

These findings underscore the importance of targeted health interventions for older adults, who represent the majority of diabetes cases in this study. Additionally, preventive measures and early screening programs could be beneficial, particularly for individuals in the 41-60 years age range, as they are also at a higher risk. Future research should further explore the age-related factors contributing to diabetes to enhance prevention and management strategies tailored to different age groups.

Table 3: Distribution of cases according to type of diabetes mellitus

	Frequency	Percent	Valid Percent	Cumulative Percent
Type 1 diabetes	267	9.8	9.8	9.8
Type 2 diabetes	2446	90.2	90.2	100.0
Total	2713	100.0	100.0	

In table (3): The vast majority of diabetes cases are attributed to Type 2 diabetes, accounting for 90.2% of the total cases. In contrast, Type 1 diabetes represents only 9.8% of cases. This indicates that Type 2 diabetes is significantly more prevalent than Type 1 diabetes.

Table 4: Distribution of cases according to the age that started of disease

	Frequency	Percent	Valid Percent	Cumulative Percent
0-10 years	44	1.6	1.6	1.6

http://www.doi.org/10.62341/ragd1834

11-20 years	69	2.5	2.5	4.2
21-40 years	587	21.6	21.6	25.8
41-60 years	1568	57.8	57.8	83.6
61-80 years	434	16.0	16.0	99.6
81-110 years	11	.4	.4	100.0
Total	2713	100.0	100.0	

Table (4) presents the distribution of registered diabetes cases at Shahat Diabetes Center according to the age at which the disease began. The majority of cases fall within the 41-60 years age group, accounting for 57.8%, indicating that this age range is the most affected by diabetes.

The 21-40 years age group follows, comprising 21.6% of cases, showing that a significant portion of patients develop diabetes at a relatively younger age. Meanwhile, the 61-80 years category represents 16.0% of cases, which is lower than the middle-aged groups but still notable.

In comparison, younger age groups have significantly lower percentages. The 11-20 years group accounts for 2.5%, while the 0-10 years category makes up only 1.6%, suggesting that childhood-onset diabetes, often associated with Type 1 diabetes, is less common among registered patients. Lastly, the 81-110 years age group has the lowest percentage, at just 0.4%.

We would like to highlight the significant difference in the percentage of the 0-10 age group between Table 2 and Table 4 to interpret. In Table 2, only 0.1% (3 cases) of cases are reported for the current age distribution, while Table 4 shows 1.6% (44 cases) for the age at which diabetes began. This discrepancy suggests that while very few children currently have diabetes, a notable number may have developed the condition at an early age.

Table 5: shows the fasting blood sugar (FBS) levels of the subjects in the study

FBS *	Frequency	Percent	Valid Percent	Cumulative Percent
0-69 mg/dL	285	10.5	10.5	10.5
70-120 mg/dL	640	23.6	23.6	34.1
121-180 mg/dL	911	33.6	33.6	67.7
181-299 mg/dL	722	26.6	26.6	94.3
300-400 mg/dL	137	5.0	5.0	99.3
401-900 mg/dL	18	.7	.7	100.0
Total	2713	100.0	100.0	

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* Normal range 70 - 120 mg/dL

Table 5 shows the distribution of diabetes patients based on their fasting blood sugar (FBS) levels at Shahat Diabetes Center. The data reveals that most patients fall within the 121-180 mg/dL range, accounting for 33.6% of the total cases. This indicates a significant spread of moderate hyperglycemia among the subjects.
The next largest group is those with FBS levels between 70-120 mg/dL, comprising 23.6% of the patients, suggesting that a notable portion of individuals maintain near-normal blood sugar levels. Conversely, the 181-299 mg/dL category includes 26.6% of cases, highlighting a substantial number of patients with higher hyperglycemia.
Fewer patients fall into the extreme FBS categories, with only 5.0% in the 300-400 mg/dL range and 0.7% exceeding 400 mg/dL. This distribution emphasizes the critical need for targeted interventions for those with elevated FBS levels, particularly in the 121-299 mg/dL range, to manage diabetes effectively and reduce complications

Table 6: shows the nationality of subjects in the study

	Frequency	Percent	Valid Percent	Cumulative Percent
Libyan	2670	98.4	98.4	98.4
non-Libyan	43	1.6	1.6	100.0
Total	2713	100.0	100.0	

Table 6 illustrates the nationality distribution of diabetes patients at the Shahat Diabetes Center. The results indicate a predominance of Libyan patients, comprising 98.4% (2670 cases) of the total sample. In contrast, non-Libyan patients represent only 1.6% (43 cases).

Table 7: shows the Correlations between the type of diabetes Mellitus and the patient's age at the disease's onset

		Patient's age at the disease's onset
Type of Diabetes	Pearson Correlation	.449**
	Sig. (2-tailed)	.000
	N	2713

**. Correlation is significant at the 0.05 level (2-tailed).

Table 7 illustrates the correlation between the type of Diabetes Mellitus and the patient's age at the onset of the disease. The Pearson

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correlation coefficient is **0.449**, indicating a moderate positive correlation between the age at onset and the type of diabetes. This suggests that as the age of the patient increases, there is a tendency for the type of diabetes to vary, potentially reflecting differences in disease progression or classification.

The significance level (Sig. 2-tailed) is **0.000**, which is below the conventional threshold of **0.05**. This implies that the correlation observed is statistically significant, reinforcing the reliability of the association between the two variables.

Table 8: Statistical calculations of some results to describe the distribution of case

		Fasting blood sugar	The age	The age at onset by years
N	Valid	2713	2713	2713 cases
	Missing	0	0	0
Mean		172.9021	63.98	47.6 years
Median		154.0000	64.00	48. years
Mode		140.00	74	46 years
Std. Deviation		77.33046	14.366	13.64422
Minimum		40.00	8	1.00
Maximum		519.00	105	93.00

Table 8 presents statistical calculations summarizing the distribution of cases related to fasting blood sugar, age, and age at onset for a sample of 2713 patients. The mean fasting blood sugar level (172.90 mg/dL) indicates a generally elevated glucose level across the sample. The median (154.00 mg/dL) suggests that half of the patients have values below this point, while the mode (140.00 mg/dL) reflects the most frequently occurring level. The high standard deviation (77.33 mg/dL) indicates considerable variability in fasting blood sugar levels among patients, with a wide range from 40.00 to 519.00 mg/dL. As for the age of patients, the data show that the average is approximately 64 years, with no significant skew indicated by the mean and median being nearly equal. The mode (74 years) reveals that many patients are clustered around this age. The standard deviation of 14.37 years reflects moderate variability, with ages ranging from as young as 8 to as old as 105. The average age at which diabetes is diagnosed is 47.6 years, which is consistent with the typical onset age for many types of diabetes. The median (48.00 years) and mode (46 years) further support this finding. The standard deviation (13.64 years) indicates some variability in age at onset, with a wide range from 1 to 93 years.

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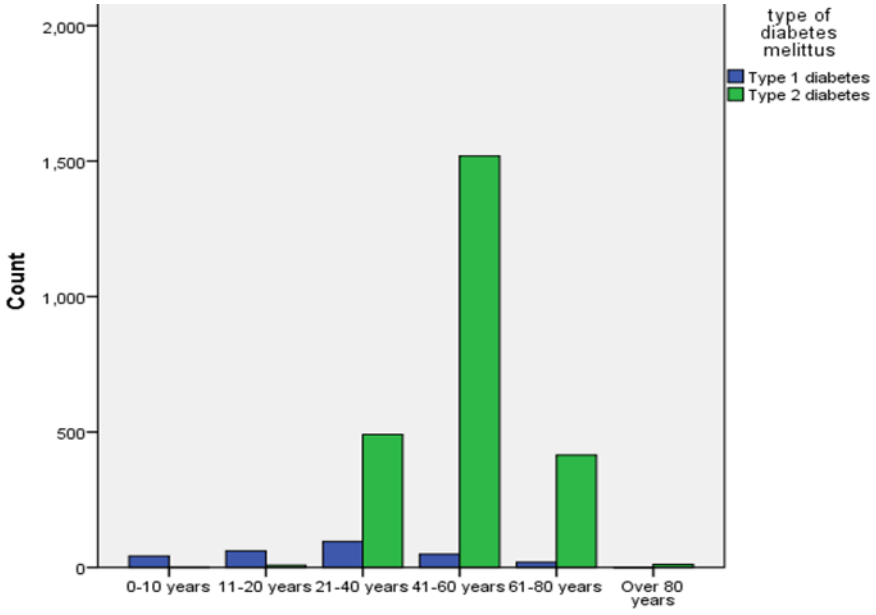

Figure 1: Comparison between the two types of Diabetes Mellitus according to age of onset of disease

Figure 1 illustrates the comparison between the two types of Diabetes Mellitus (Type 1 and Type 2) based on the age of the case at the beginning of the disease. The data is presented in a histogram format, showing the count of cases across various age groups. In terms of age distribution, we can say that the majority of cases are concentrated in the 41-60 years and 61-80 years age brackets, with the highest count observed in the 61-80 years category.

There are significantly fewer cases of both types of diabetes in the younger age groups (0-10 years, 11-20 years, and 21-40 years). As for, the type of Diabetes, Type 2 diabetes overwhelmingly dominates the counts in older age groups, particularly from 41 years and above, while type 1 diabetes shows a much lower incidence, primarily affecting younger individuals, with a slight presence in the 21-40 years age range. Overall trends the data indicate that Type 2 diabetes is more prevalent among older adults, whereas Type 1 diabetes occurs more frequently in childhood and adolescence. this trend supports the established understanding that Type 2 diabetes is associated with age-related factors and lifestyle, while Type 1 diabetes has a different etiology primarily affecting younger populations. Eventually Figure 1 effectively highlights the disparity in age of onset between Type 1 and Type 2 Diabetes Mellitus, emphasizing the predominance of Type 2 diabetes in older age

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groups. These insights may inform targeted prevention and management strategies tailored to different age demographics within diabetic populations

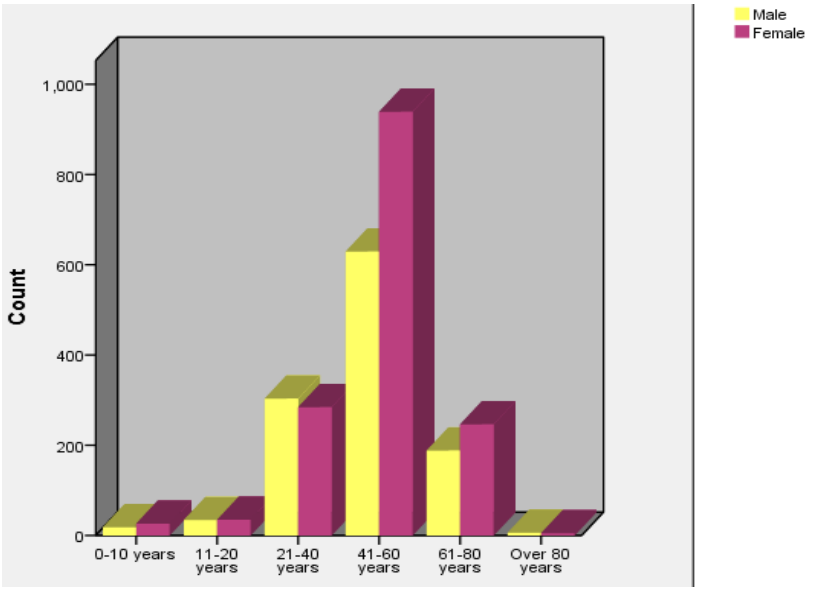

Figure 2: Comparison between the two genders according to age period

Figure 2 illustrates the distribution of two genders across different age groups. The data is represented through a stacked bar chart, concerning, gender comparison in the 0-10 years and 11-20 years categories, the count of males and females is relatively balanced. As for from 21-40 years to 41-60 years, the number of males exceeds that of females, indicating a potential gender disparity in these age groups. In looking at the 61-80 years age group, can observe both genders decrease, the drop is more pronounced for males. Regarding individuals over 80 years are represented by very few, with a slightly higher count of females. Overall, the figure highlights a notable gender imbalance in middle-aged groups, with a more even distribution in the younger age brackets and a significant decline in counts as age increases, particularly for males.

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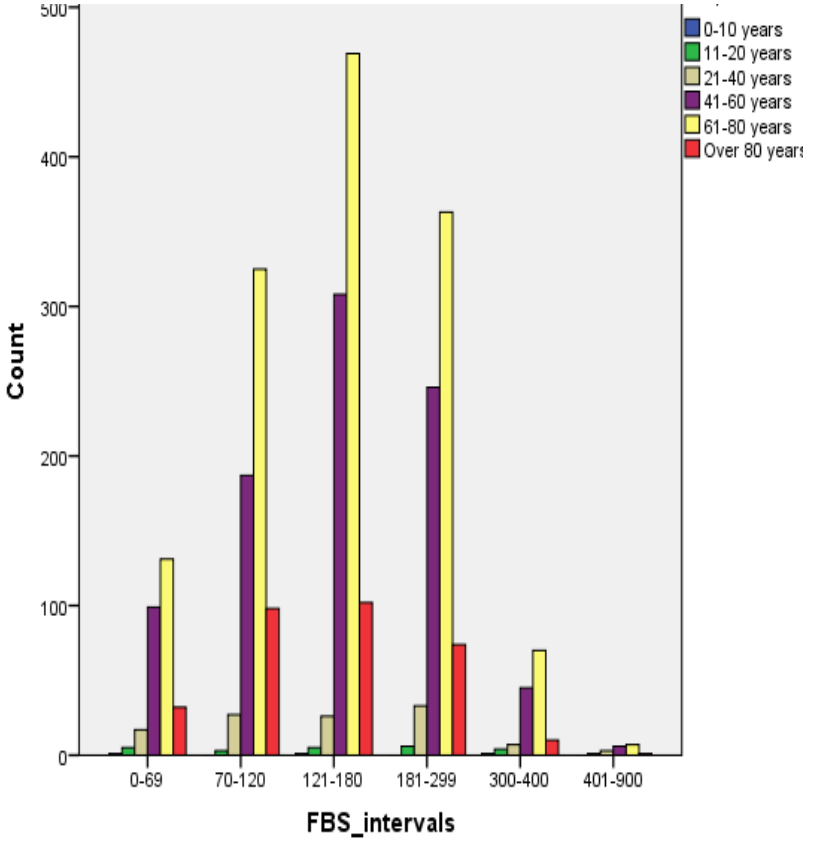

Figure 3 shows the association between age period and fasting blood sugar measurements

Figure 3 presents the distribution of fasting blood sugar (FBS) measurement intervals across various age groups, organized in a bar chart format. When analyzing this diagram can observe that The most frequent FBS intervals appear in the ranges of 121-180 mg/dL and 181-299 mg/dL, indicating a significant concentration of individuals with elevated blood sugar levels within these ranges. Age Group Analysis The 0-40 years age group shows the lowest counts across all FBS intervals, suggesting that younger individuals are less likely to have elevated FBS levels.

As age increases, particularly in the 41-60 years and 61-80 years categories, there is a marked increase in counts within higher FBS intervals, reflecting a higher incidence of elevated blood sugar levels.

The over 80 years category has limited representation, but the counts in higher FBS intervals indicate that older adults also experience elevated blood sugar levels.

http://www.doi.org/10.62341/ragd1834

Overall, the data suggests that the risk of elevated fasting blood sugar levels increases with age, particularly in middle-aged and older populations. This finding emphasizes the need for targeted screening and management of blood sugar levels in these age groups.

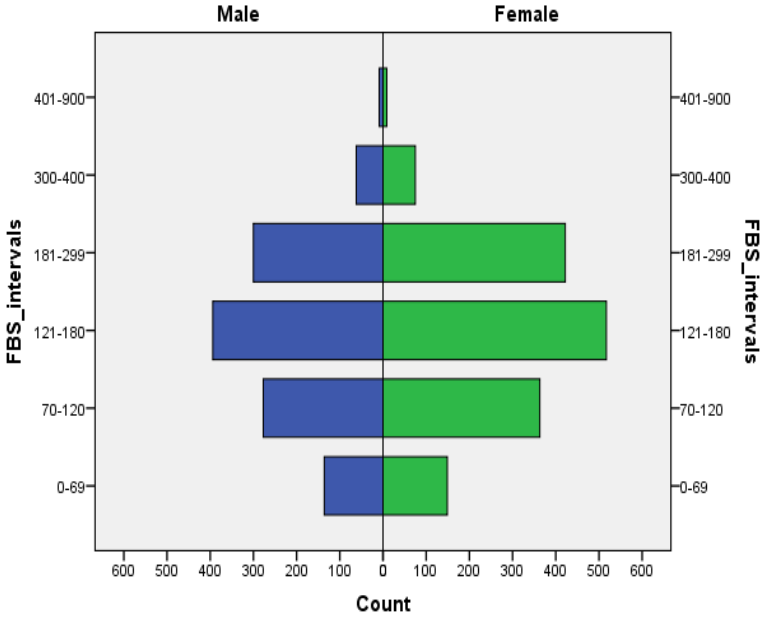

Figure 4: Association between the gender and FBS level

Figure 4 illustrates the relationship between gender and fasting blood sugar (FBS) levels, represented through horizontal bar charts for males and females across various FBS intervals. Males tend to have higher counts in the elevated FBS intervals compared to females, indicating a potential gender disparity in fasting blood sugar levels.

The data suggests that males may be at a higher risk for elevated FBS levels, underscoring the importance of gender-specific health interventions.

Overall, the figure highlights a significant association between gender and fasting blood sugar levels, with males exhibiting higher counts in the elevated intervals.

http://www.doi.org/10.62341/ragd1834

Table 9: Correlations between some parameters in the study

		Age	FBS	Disease beginning age	Type of Diabetes	Gender
Age	Pearson Correlation	1	-.091**	.839**	.442**	.068**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	2713	2713	2713	2713	2713
FBS	Pearson Correlation	-.091**	1	-.128**	-.087**	.020
	Sig. (2-tailed)	.000		.000	.000	.294
	N	2713	2713	2713	2713	2713
Disease beginning age	Pearson Correlation	.839**	-.128**	1	.452**	.051**
	Sig. (2-tailed)	.000	.000		.000	.008
	N	2713	2713	2713	2713	2713
Type of Diabetes	Pearson Correlation	.442**	-.087**	.452**	1	-.010
	Sig. (2-tailed)	.000	.000	.000		.609
	N	2713	2713	2713	2713	2713
Gender	Pearson Correlation	.068**	.020	.051**	-.010	1
	Sig. (2-tailed)	.000	.294	.008	.609	
	N	2713	2713	2713	2713	2713
**.Note: Correlation is significant at the 0.05 level (2-tailed).						

Table 9 presents the Pearson correlation coefficients and significance levels (p-values) for various parameters in the study. where the findings were as follows as for Age and Fasting Blood Sugar, there is a weak negative correlation ($r = -0.091$, $p < 0.05$), indicating that as age increases, fasting blood sugar tends to decrease slightly. Respecting age and Age at the beginning of disease, A strong positive correlation ($r = 0.839$, $p < 0.05$) suggests that older age is associated with a later onset of the disease. With regards to age and Type of Diabetes Mellitus a moderate positive correlation ($r = 0.442$, $p < 0.05$) indicates that older age is related to a specific type of diabetes mellitus. As respects age at the beginning of the disease and type of Diabetes Mellitus, there is a moderate positive correlation ($r = 0.452$, $p < 0.05$), indicating that the age at which the disease begins is related to the type of diabetes diagnosis. Overall, the findings indicate significant correlations primarily between age, age at disease onset, and type of diabetes mellitus, suggesting that age influences both the onset and type of diabetes. Fasting blood sugar shows weak negative correlations with age and

http://www.doi.org/10.62341/ragd1834

age at disease onset, while gender has minimal correlation with the other variables.

Discussion

The present study shows the distribution of DM in Shahat City by reviewing records of all the diabetic patients registered in the Shahat Center for Diabetes.. Our finding was greater than the results obtained from a study conducted in Saudi Arabia (Alanazi, et al., 2017) was 5% while was less than the reported diffusion data from Bahrain (26%) (Hamadeh, 2000) and Oman (16%) (Al-Lawati, et al., 2002). 2010 study estimated that more than 92 million Chinese have the disease, with another 150 million showing early symptoms (China faces 'diabetes epidemic', research suggests, 2010). The current study revealed that the high-frequent DM age period was 61 to 80 by 47 %A. Another research in Canada detected that about 2.4 million Canadians (6.8%) have been diagnosed with diabetes (Public Health Agency of Canada., 2011). Age is a main factor of diabetes since blood glucose levels gravitate to ascend with age (West, 1978) .

This study found a noteworthy relation between age and blood glucose level in diagnosed diabetic cases. A survey carried out in Saudi Arabia (Alqurashi, et al., 2011) showed that the mean age for the beginning of diabetes in males (58 yrs.) and females (53 yrs.).

Let's look at the percentage of cases in each age period. We'll observe that the proportion of diabetes cases in the 21-40 years period was 4.2 %, in the 41-60 years period was 32.8% and in the 61-80 years period was 50.3, which indicates that the likelihood of getting diabetes increases with age. These findings run with a study conducted in Iran, which showed that the widespread presence of DM increased with aging, from 4% in participants aged 30 to 39 to 22.9% in people aged 60 or older (Rahmanian, et al., 2013). Another study in Saudi Arabia revealed that the mean age of 99 type 2 diabetic patients was 57 years (Assim & Abdulrahman, 2006).

Concerning sex, this study shows that females had a greater proportion of diabetic patients than males (female =56.6%, male = 43.4%). this outcome concurs with the results of a Saudi essay that proved that the percentage of females higher than males (57.5% females, 42.5% males) diabetes, But disagrees with the Canadian paper that uncovered a higher percentage of males than females (46% females, 54% males).

http://www.doi.org/10.62341/ragd1834

Conclusion

The study found that Type 2 diabetes is predominant (90.2%), with higher prevalence in older age groups (61-80 years). Females were more affected than males (56.6% vs. 43.4%). Age was a significant risk factor, with diabetes incidence increasing with age. Elevated fasting blood sugar levels were common, particularly in middle-aged and older adults. The findings highlight the need for targeted interventions, especially for older adults and females, to manage and prevent diabetes effectively in the Libyan population.

Acknowledgment

We thank everyone participating in the study for their collaboration. Special thanks are due to the Diabetic Shahat Center which provided us with valuable information to achieve this research, in addition, they were very cooperative.

Conflict of Interest

The authors announced that they have no contending interests

Limitations

We faced some halts in conducting this study such as incomplete data on some of the enrolled diabetic cases in the center this led to the excluded any cases registered having incomplete information in the diabetic Shahat center from this study.

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