

Skin Manifestations of Diabetes Mellitus among Iraqi Patients

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Abstract Diabetes mellitus (DM) is a clinical syndrome that is frequently associated by a variety of skin manifestations that commonly serve as ports of entry of different microorganisms. Although diabetes mellitus can be asymptomatic, many patients present with wide spectrum of manifestations. Skin manifestations can be associated with both type 1 & type 2 Diabetes and were seen in patients who use insulin as well as those who use oral hypoglycemic agents to control their glucose level. Early recognition of these skin manifestations assists in early diagnosis and helps to lead toward appropriate treatment for diabetes mellitus patients. Early diagnosis also share in preventing long-term complications. The present cross sectional study evaluates the frequency of skin manifestations in 110 diabetic Iraqi patients in Baghdad covering both males and females from different ethnicities and occupations. This study was conducted over the period of 2005 to 2006 including patients over 20 to 75 years age. A specific questionnaire was designed then distributed to all consenting patients. The skin manifestations observed were skin infections (19.4%), itching (12.1%), skin atrophy and inter-digital maceration (10.5%), waxy skin (9.7%), lipodystrophy (9.7%), skin thickening (7.2%), sweating disturbance (7.2%), DM dermopathy (6.5%), yellow nails (6.5%) and others. The different types of infections observed in diabetic patients involved in this study are discussed thoroughly. Infection, itching, skin atrophy and sweat disturbances are the most common three initial skin manifestations in Diabetes Mellitus patients of this work. A comparison is made between this study and other studies especially with the studies in Jordan and Pakistan and both agreement and disagreement are discussed. The present study reveals that it took more than 10 years for skin manifestations to appear in 60% of the patients. On the other hand, no patient reported manifestation at 30 or more years since they have been diagnosed with Diabetes mellitus. The maximum number of patients reported skin manifestations was at 17-18 year since the onset of Diabetes mellitus diagnosis. The paper concluded that the most cutaneous manifestations in DM Iraqi patients in Baghdad are bacterial and other skin infections.

Keywords: candida, diabetes mellitus, hyperglycemia, itching, infection, skin manifestations

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1. Introduction

Diabetes mellitus is a wide spread disease. Wild et. al. [17] reported that in the year 2000, there were about 171 million diabetes mellitus cases worldwide in patients ages 20 years or more, 17 million of these cases were found in the United States of America, making the US the third highest country in the prevalence of Diabetes mellitus after India and China. In 2010, the International Diabetes Federation [9] reported a diabetes prevalence of 12.3% in the US and 7.8% in Iraq. However, in 2008, Mansour et al [12] reported a Diabetes prevalence of 7.43% in Basrah, Iraq and in 2011 Al-Windi and Ali [2] reported a prevalence of 6.8% in Sulaimani, Iraq. Unfortunately, the authors were unable to find any published articles regarding the prevalence of diabetes in Baghdad, Iraq. For this reason the focus of this study is the prevalence of Diabetes Mellitus in patients from Baghdad. This study

also aims at showing the prevalence of individual Diabetes skin manifestations in relation to gender, length of years since the diagnosis of Diabetes Mellitus and response to treatment.

2. Types of Diabetes Mellitus

Diabetes mellitus (DM) is a disease that is frequently associated with skin manifestations and can be classified into three main types; 1, 2 and 3 as reported by Alberti and Zimmet [1]. Type 1 is known as insulin dependent DM or Juvenile-onset DM in addition to autoimmune disease and non-autoimmune with beta cell destruction. Type 2 is non-insulin dependent DM or adult onset DM with varying degrees of insulin resistance and insulin hyposecretion. Type 3 DM is secondary DM occurring as a complication of pancreatic, hormonal or genetic disease

or following ingestion of certain drugs or chemical compounds.

3. Skin Manifestations in Diabetes Mellitus

Cutaneous manifestations of Diabetes Mellitus are common and frequently serve as ports of entry for different micro-organisms. Exposure to such micro-organisms might result in secondary infections.

Patients with type 1 Diabetes Mellitus are commonly presented with autoimmune-related skin manifestations such as Vitiligo, Lichen planus, ect. while patients with type 2 Diabetes Mellitus typically develop skin infections like Thick skin, Granuloma annulare, etc.

Unfortunately, some cases of Diabetes Mellitus stay undiagnosed until complications appear. Moniliasis can be an early sign of such cases as reported by Van Hattem et al [18].

4. Biochemical Considerations in DM

Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype, hyperglycemia.

Depending on the etiology of DM, many factors might cause hyperglycemia, including reduced insulin secretion, decrease glucose usage and increased glucose production.

The process of non-enzymatic glycosylation occurs to a minor extent at normal blood sugar concentrations. This gradual glycosylation of proteins may be responsible for some of the skin changes associated with aging. This process is apparently accelerated in persons with elevated blood sugars. Most proteins evaluated seem to be involved by this reaction which results in changes in the physical and chemical properties. According to Druggly [6], the glycosylation of the red cell membrane is apparently responsible for the stiffness of diabetic erythrocytes.

5. Clinical Features of DM

Diabetic patients may be either asymptomatic or presented with skin turgor, dry furred tongue, cracked lips, tachycardia, hypotension, polyuria, polydipsia, increased intracranial pressure symptoms, harsh acidotic breathing, mental apathy, confusion and coma. Fatigue and recurrent infections like fungal infection are not uncommon. Symptoms due to ketosis are expressed through vomiting and abnormal smell. Diabetic retinopathy can be simple, pre-proliferative or proliferative. Diabetic neuropathy can be sensory, motor, mononuritis or autonomic with impaired reflexes. Diabetic nephropathy expressed through leg edema, proteinuria and accelerated arteriosclerosis.

6. Collection of Data

For the purpose of this research paper, the collection of data was made in different medical centers in Baghdad, Iraq. A specific questionnaire was designed then distributed to patients in general hospitals as well as private clinics (private sectors).

Ethical clearance and IRB approval of this study was granted through the medical centers and clinics that allowed the authors to perform the survey.

For the data to be reliable, a proper and representative sample size should be chosen that covers different age groups, different sex, race, occupation, etc. Accordingly, 200 consenting patients were interviewed during the period 2005-2006, namely 96 males and 104 females. Among them, only 110 patients had skin manifestations. To protect patients' privacy every patient, name was replaced by a code. The survey data sheet questionnaire, covered two parts. First, consenting participants filled, in the presence of one of the authors the demographic data such as name of the patient, age, gender, race, occupation, type of DM, approximate date of onset of DM, the treatment he/she received and when the given treatment started, his/her response to the treatment, what was the first, second and third cutaneous manifestation he/she observed and in what chronological order, was their DM controlled.

The second part of the survey data sheet, questionnaire included a checklist of the possible skin manifestations seen in diabetic patients. A thorough head to toe physical examination was performed with all patients including searching the clinical skin manifestations related to diabetes mellitus. After full examination of the pathologies observed, skin manifestations related to DM were reported and documented by one of the authors (physicians) in the survey data sheet (questionnaire). Spreadsheets, tables, graphs, and figures were designed using Microsoft Excel.

This cross sectional study covered a wide age range; participants had an age range between 20 to 75 years.

7. Analysis and Results of Collected Data

The collected data was formed in tables and figures. Table 1 shows both the absolute frequency (patients) and the corresponding relative frequency of the various skin manifestations related to Diabetes mellitus that were observed by the authors of this study.

Table 1. Frequency of Skin Manifestations

Skin manifestation	absolute frequency (Patients)	Relative frequency (%)
Infections	48	19.4
Itching	30	12.1
Skin atrophy, interdigital Maceration	26	10.5
Waxy skin	24	9.7
Lipodystrophy	24	9.7
Skin thickening	18	7.2
Sweating disturbance	18	7.2
DM dermopathy	16	6.5
Yellow nail	16	6.5
Ulcer	8	3.2
Carotenosis	8	3.2
Diabetic microangiopathy	6	2.4
Necrobiosis lipodica	2	0.8
Digital sclerosis	2	0.8
Xanthelasma	2	0.8
Others (Granuloma annulare, Acanthosis Nigricans, Wet gangrene of foot, Vitillgo...)	0	0
Total no. of manifestations in the 110 patients	248	100

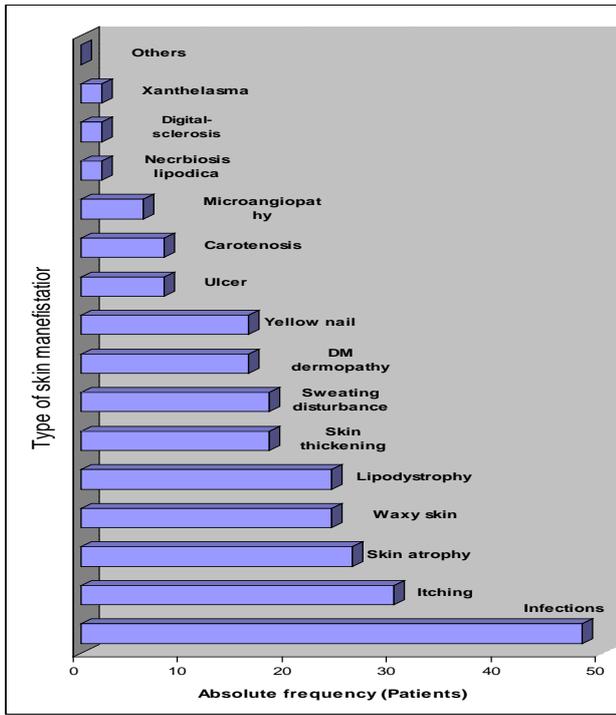


Figure 1. Frequency of skin manifestation in the studied Iraqi diabetic Patients

It is quite obvious from Table 1 and Figure 1 that the most common cutaneous manifestation is infections. This was present in 48 patients representing (19.4%) from all observed skin manifestations.

Skin infections prevalence was followed by itching, which was noticed in 30 patients representing (12.1%) of the observed skin manifestations.

Different types of infections observed in diabetic patients involved in this study are shown in Table 2 and Figure 2.

Table 2. Different Types of Infections

Skin manifestation	absolute frequency (manifestations)	Relative frequency (%)
Folliculitis	34	27.4
Candida	28	22.5
Boil	18	14.5
Abscess	10	8.1
Cellulites	10	8.1
Viral	10	8.1
Erysipelas	8	6.4
P. Versicolor	4	3.2
Tineas	2	1.6
Total	124	100

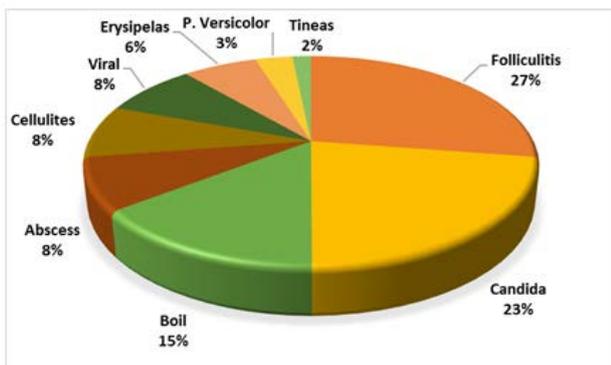


Figure 2. Pie chart for different types of infections observed in diabetic patients involved in this study

The Pie chart of Figure 2 shows the different types of infections observed in diabetic patients involved in this study.

It is quite obvious from this chart and Table 2 that folliculitis predominates, while Tinea infections has low prevalence.

From the observed skin infections mentioned in Table 2, there were 80 manifestations caused by bacterial origin, including folliculitis, boil, abscess, cellulites and erysipelas representing a total of 64.5% of the observed skin infections.

From the observed skin infections, there were 28 candida infections which represented 22.5% in total observed skin infections.

To show the prevalence of the first manifestation to appear, Table 3 and Figure 3 present a summary of the first manifestations observed in this study.

Table 3. First Manifestation to Appear

Skin manifestation	absolute frequency (patients)	Relative frequency (%)
Infections	48	43.6
Folliculitis	20	18.2
Boil	8	7.3
Abscess	8	7.3
Cellulites	8	7.3
Candida	4	3.6
Itching	46	41.8
Sweating disturbances & Skin Atrophy	4	3.6
DM dermopathy	4	3.6
Ulcer	4	3.6
Lipodystrophy	2	1.8
Waxy skin	2	1.8
Total	110	100

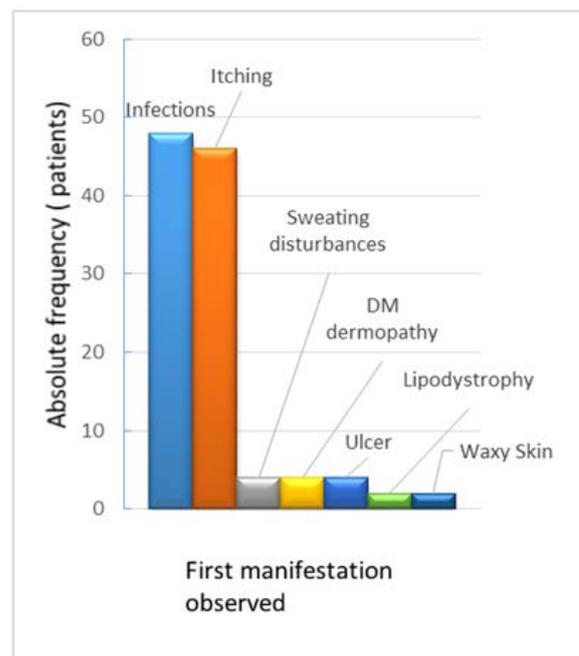


Figure 3. First manifestation reported by DM patients in Baghdad, Iraq

According to Table 3 and Figure 3, itching and infection are the most common initial presentation in DM patients. Some patients reported other initial manifestations, such as: ulcer, waxy skin, etc.

Although skin manifestations can be observed early, some skin manifestations can take 20 to 25 years till they appear, as shown in Table 4 and Figure 4.

Table 4. Number of Years DM Started Before the Appearance of Skin Manifestations

No. of years	Absolute frequency (Patients)	Relative frequency (%)
5	22	20
10	22	20
15	24	22
20	24	22
25	18	16
30	0	0
Total	110	100

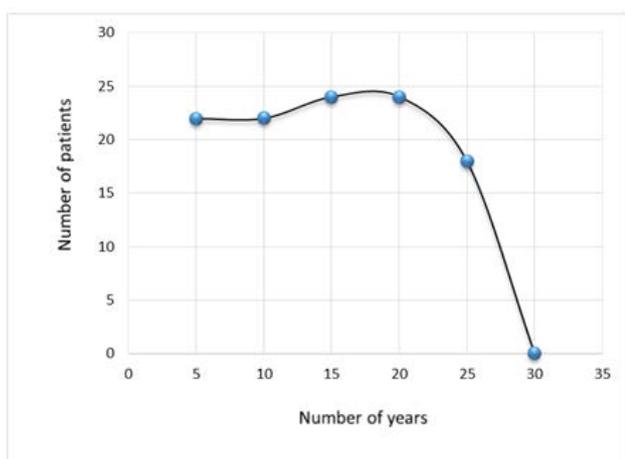


Figure 4. Number of years DM started before the appearance of skin manifestations

Table 4 and Figure 4 show that it took more than 10 years for skin manifestations to appear in 66 patients (60%). On the other hand, no patient reported manifestations at 30 or more years.

It is also obvious from Figure 4 that the maximum number of patients with skin manifestations was reported at 17-18 years of the diagnosis of DM

Glucose level control doesn't significantly affect the prevalence of the skin manifestations as it is shown in Table 5.

Table 5. Effect of DM Control on Skin Manifestations

Status of Control	Absolute frequency (Patients)	Relative frequency (%)
Controlled DM	80	72.73
Un-Controlled DM	30	27.27
Total	110	100

Table 5 shows that 80 patients (72.73%) developed skin manifestations, although their glucose level was well controlled.

Other data that was obtained through the survey performed included type of DM, response to treatment, type of treatment (oral hypoglycemic agents "OHA" or insulin) is presented in Table 6.

Although many patients had good response to treatment, some still had a lot of cutaneous manifestations. Most of them were type 1 DM. Patients who were using OHA

reported less skin manifestations than those who were on insulin.

Table 6. Factors affecting DM Skin Manifestations Prevalence

	Absolute frequency (Patients)	Relative frequency (%)
Effect of response to treatment on DM skin manifestation prevalence		
Good response	90	81.8
Poor response	20	18.2
Total	110	100
Effect of DM type on DM skin manifestation prevalence		
DM type 1	62	56.4
DM type 2	48	43.6
Total	110	100
Effect of Treatment modality on DM skin manifestation prevalence		
Patient used OHA	48	43.6
Patient used Insulin	62	56.4
Total	110	100

8. Comparison with Other Studies in Different Countries

To compare the results of this work with relevant studies nationally and internationally, two published papers were selected. The study performed by Najdawi and Fa'ouri [16] dealt with Diabetes mellitus in Jordan covering a sample size of 232 patients, while the study by Ahmed et. al [3] was devoted to 350 patients in Pakistan. This comparison covers the first three most common skin manifestations as shown in Figure 5.

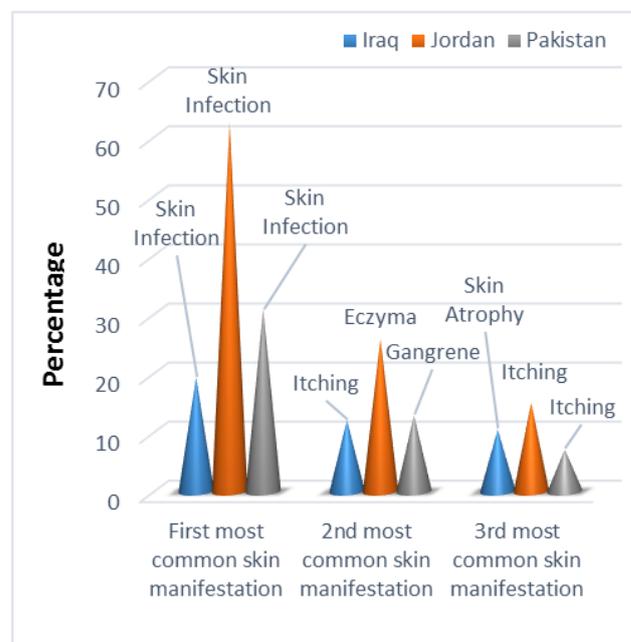


Figure 5. Comparison of this study with other studies regarding the first three most common skin manifestations

It is quite obvious from this figure that all three countries reported skin infections as the first most common skin manifestation in DM patients. However, due to the difference in climatic conditions and cultural habits, skin infections are quite pronounced in Jordan and the least in Iraq. This might be due to the fact that health care

is free in Iraq, while those who live in Jordan need to purchase health insurance to get health care.

Regarding the second most common skin manifestation, it is apparent that there is no unique manifestation for the three countries. The present study shows that itching is the second most common manifestation, while the studies in Jordan and Pakistan reported Eczema, Gangrene and ulcer respectively. This difference might be due to cultural habits such as bare foot gait, or ill-fitting footwear in Pakistan as reported by Ahmed et. al [3]. Similarly, the third most common skin manifestation in DM patients in this study was Skin atrophy and itching in both Jordan and Pakistan studies.

9. Discussion

Diabetes mellitus is a common disorder and nearly all individuals with diabetes might develop skin manifestations. Many of these manifestations might be explained on the basis of the attachment of glucose to proteins and the subsequent metabolism of this combination, which causes changes in structure, function and color.

The most common cutaneous manifestation seen in this research work was infection which was in agreement with the studies performed in Jordan and Pakistan. Druggy [6] reported that oral candidiasis was found in 60% of the patients he studied, while this study reported that bacterial infections were the most common type of infection reported. This difference can be attributed to an increased incidence of immune compromised patients among the sample studied by Druggy [6].

Waxy skin was seen in 1.8% of the patients which was less than the results shown by Huntley [8], 10% and this may be related to the differences in the genetic and the racial causes of DM in different countries and different continents.

Diabetic dermopathy was seen in 3.6% of the patients in this study which was less than the 14% obtained by Huntley [8] and Murphy [13]. Morgan and Schwartz [14] reported Diabetic Dermopathy as the most common cutaneous manifestation of DM in the US. The low prevalence of diabetic dermopathy in this study may be related to the availability of free health care in Iraq which might be contributed to an early diagnosis and prevention of chronic complications.

Skin ulcer was seen in 3.6% of the patients of this work which is in agreement with the 5% given by Freedberg [7].

Cutaneous manifestations started to appear in different intervals after the onset of DM ranging from 5 to 25 years, while Druggy [6] showed that it appeared with the age from onset ranging from 14 to 37 years and that most patients developed manifestations after 10 years from the onset (80%). This difference might be attributed to a longer life span in the sample studied by Druggy as compared with the population examined in this study.

There were no substantial differences between male and female incidences of cutaneous manifestations in Baghdad as it appeared in 52% females and 48% males. This is in agreement with the study performed by Ahmed et al [3] who reported that 55.1 % were females and 44.9% were males.

The incidence of DM I in those with skin manifestations was 56.4%, Druggy [6] reported a

prevalence of 12% as insulin-dependent diabetes mellitus. The incidence of DM II was 43.6% in this study as compared with 25% reported by Al-Masommi [4] for his study in Bahrain. The study by Muhssen [15] in Saudi Arabia showed that DM II was 85%, while it was only 10% in Oman as reported by Al-Mahrous [5].

In the present study, about 56% of the patients having skin manifestation were on insulin, which was close to the 62% reported by Khan [10] and Kennedy et. al [11].

10. Conclusions & Recommendations

The main conclusions and recommendations of this work can be summarized as follows:

1. Cutaneous manifestations are fairly common among patients complaining of diabetes mellitus. The most common cutaneous manifestations seen in DM patients are bacterial and other skin infections. This is in agreement with the studies carried out in Jordan and Pakistan.
2. The appearance of the cutaneous manifestation is affected by Chronicity.
3. Infection, itching, skin atrophy and sweat disturbances are the most common three initial skin manifestations in Diabetes Mellitus patients of this work.
4. The maximum number of Iraqi patients with skin manifestation was observed 17-18 years after the onset of diabetes mellitus in the participants.
5. There is no substantial difference between males and females in the incidence of the cutaneous manifestations.
6. It is strongly recommended to extend this study to cover other Governorates in Iraq.
7. It is recommended to focus the attention to the primary skin manifestations as it may lead to the diagnosis of DM.

It is recommended to educate the patients regarding glucose level control, compliance with medications, and skin hygiene.

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