

**Original Article**

# The study of immunity dysfunction and high susceptibility of infections in patients with diabetes and pre-diabetes: A prescription based study

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## Abstract

**Background:** Diabetes, being the most prevalent co-morbidity associated with various metabolic complaints and is considered as the principal emerging health issue of 21st century. As along with conformist complications, the disease due to having immuno-deficiency characteristics that leads to low functioning of T-cells and neutrophils consequently becomes highly accountable for frequent infections. The present study was conducted to analyze the co-morbidity of infections with diabetes and to describe and control the foremost complications of infectious diseases and their management allied with this metabolic disorder.

**Methodology:** A cross sectional prospective study was conducted in the diabetic clinics of public and private sector hospitals of Karachi. 170 diabetic patients were included in the study, 26 were tested to be pre-diabetic and while the remaining 144 were not only diabetic also on antibiotics. The data was analyzed using the SPSS version 17.

**Results:** The data of study reveals that the frequency of infection was found utmost in diabetic patients, as the antibiotics prescription rate and antiseptic utilization for treating various infections was increased among these cases. As among 144 diabetic patients 50% were found to have frequent infection as were often prescribe antibiotics.

**Conclusion:** We concluded, severe hyperglycemia can drastically alter body immune response against pathogens that strongly favors the deprived outcomes and severe complications. Health care professionals are required to encourage the patients to follow the recommendations and guidelines to reduce the morbidity of diabetes along with infection and prescribe drugs of choice for the management of pathogenic bacteria at early phase to avoid the severity of pathogenicity and recommendation of supplements and medicine that enhances the immunity must be enforced.

## Keywords

Diabetes, Pre-Diabetic, Prescribing Error, Immunity Dysfunction, Infection susceptibility.

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## Introduction

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The research has established the fact about diabetes for having strong tendency of developing infections and it is evident through previous data that diabetics receive treatment for infections more frequently than non-diabetics<sup>1&2</sup>. It is apparent that diabetes along with its associated complications, is highly responsible for demoralizing the immune responses including lowering of chemotaxis, phagocytosis, and antigen response against microbes, furthermore the reduction in T-cell functioning facilitates the progression of infection and symptomatic disorder in hyperglycemia<sup>3&4</sup>.

The association of diabetes with an increased risk of infections has become a causative factor for high rate of mortality and patients with diabetes are at two-fold higher risk for community-acquired enterobacterial, pneumococcal and streptococcal infections<sup>5-7</sup>. Which possess an extreme risk and danger for community health system specifically in developing countries. Along with other infections in hyperglycemic state, tuberculosis is among the most common observations among diabetes patients and accordingly the condition demands routine screening of diabetic patients for tuberculosis. More often hyperglycemia was found to be additionally susceptible for urinary tract infections<sup>8</sup>, further the antimicrobial resistance encourages the situation of asymptomatic bacteriuria specifically in female diabetes patients. *Escherichia coli* isolated from the urine, was found to be growing more when examined after incubation and addition of glucose experimentally<sup>8&9</sup>.

The causative factor of infection can be mono or polymicrobial. A research conducted by Canadian Primary Care Sentinel Surveillance Network, approximately seventeen hundreds diabetic patients were found to have different comorbidities and even after setting

confounders, they were observed at increased risk of infections<sup>10</sup>. This however, reveals that confounders cannot be supportive to control infections in diabetes<sup>8</sup>. Skin and soft tissue infections are more commonly observed and found associated with diabetes while often seen with genitourinary, respiratory and gastrointestinal infections, whereas musculoskeletal and viral infections are very rarely observed<sup>3,11-13</sup>. Fungal infections are also very common among diabetics and it may also lead to fungal cystitis, due to hyperglycation, hence leading to the urinary tract obstruction<sup>14</sup>. One of the most important unremitting complication of Hyperglycemia is foot infection<sup>15-18</sup>. As the condition at its severity results in death of the patient, as the symptoms of such infections in diabetes are very inconsistent and accountable for a long delay in conclusion that whether to treat “non-limb threatening” or “limb-threatening”<sup>15-18</sup>.

Polymorphonuclear neutrophil (PMN) functioning are altered in diabetic patients, which may increase the risk of vascular complications and infectious episodes<sup>19</sup>. In a study, the PMN cell performance test was conducted on a group of 61 diabetic patients of either type<sup>19</sup>. The test was performed after stimulation by opsonized zymosan and low activity of chemotaxes was observed in comparison to the healthy controls, interestingly the type of diabetes and age did not show any consequence with the happening of infections with hyperglycemia<sup>20</sup>.

Opsonization in hyperglycemia may also decline due to binding of glucose to the protein of human immune system which in turn unable the protein to attach microbial surface to thereby opsonize<sup>21</sup>. Infection is recognized as the most frequent cause of ketoacidosis as acute infections lead to difficulty in controlling blood sugar levels<sup>21</sup>. Immunoglobulin, the significant component of immune system, responsible for recognizing to specific antigens that are mostly pathogenic microbes and causes

their devastation. Whereas in diabetic patients increased HbA1c causes the deactivation of biological function of these antibodies. An experiment conducted with human and rabbit immunoglobulin and observed that incubation of antibodies with glucose exhibits a prominent decline of biological activity of immunoglobulin<sup>14&22</sup>.

The predominance of diabetes, as a major health problem, has graded Pakistan among ten highest regions of the world with this disease outburst and more millions will suffer through this endemic condition by the next decade<sup>23</sup>. Moreover the suppression of immunity in diabetes patients is another precipitating threat to the healthcare. Through this study our aim was to analyze the frequency of medication inclusion under prescription of hyperglycemic patients, to identify the relevancy of high blood glucose level with the increasing number of infections in body. The study also helped to analyze the immunity level of diabetic patient's verses pre-diabetics.

## Methodology

A cross-sectional prospective study was conducted at diabetes clinics of public and private sector of Karachi to evaluate the prescribing frequency of antimicrobial, antifungal along with other essential medicines. The study duration was of 6 months i.e. from February to July 2018. A total of 196 patients were included in the study. Of which 26 were pre-diabetic and 170 were diabetes patients on medical prescriptions for treatment of

infections associated with their diabetic profile. Medical prescriptions of diabetic patients receiving regime of drugs from different hospitals and clinics were considered in inclusive criteria while the prescriptions that were not clearly written were excluded. The correlation of vitamin intake with onset of infections was analyzed to establish the co-morbidity of diabetes with infections and possible control by boosting immunity via taking antioxidants and vitamins. The collected data was analyzed through SPSS 17, descriptive statistics was used for data presentation as frequency and percentages.

## Results

The study was based on a sample of 196 patients out of which 54.1% were males and 45.8% were females as shown in table I. The subjects under the age group of 41-60 years were found more prone to diabetes as compared to the other study groups.

Out of 170 diabetic patients, the outcome showed (n=91) patient population was on prescribed medication. Having different infections that indicate the almost fifty percent chances of high jeopardy of occurring infections among diabetic patients and hyperglycemic condition increases the susceptibility to various types of infections. Hence there was significant correlation between diabetes and infection notified as indicated with the prescribed medication rate among diabetics (Table 2).

**Table I: Socio-demographic characteristics of study subjects (n= 196)**

Characteristics	Sub-categories	Groups	
		Diabetic (n=170)	Pre-diabetic (n=26)
Gender	Male	92(54.1)	16(61.5)
	Female	78 (45.8)	10(38.4)

**Table 2: Frequency of prescribing medication to Diabetic & Pre-diabetic Patients**

Groups	Frequency for Prescribing Medication		% Correlation
	Prescribed	Not Prescribed	
Pre-Diabetic	22	04	84.6%
Diabetic	69	75	47.9%

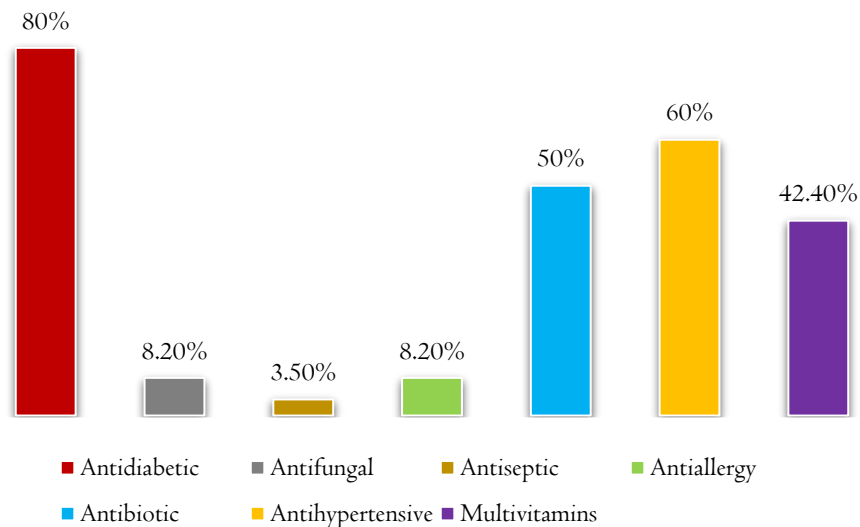
**Figure I: Class of Medicine Prescribed to Diabetic Patients**

Figure I shows the ratio of medicines prescribed to diabetes patients. Apart from antidiabetic medication, most common medicine prescribed was for hypertension followed by antibiotics, multivitamin, anti-allergy, antifungal and antiseptic.

## Discussion

Research reveals that due to the metabolic and genetic disorders, the body's immune system becomes weakened that results in low responses to antigen in diabetes and causes the high susceptibility of different infections. Controlled in blood glucose level through the insulin infusion highly accountable for the improvement of the activity of neutrophils<sup>24</sup>. Majority of the study subjects were diabetic in both genders (Table I). According to the recorded demographic values of both the groups, diabetes was found more prevalent among females as compared to males, Among pre-diabetic the majority of sample was found

to be on prescribed medication that showed high probability of infections among the group however the percentage correlation of diabetic group was observed at decline as compared to pre-diabetic (Table 2). This interesting figure directs the study toward a new dimension which can be explained on the basis of the phenomenon, it is a known fact that hyperglycemia is associated with the occurrence of infections but if the symptoms are not apparent it accounts for the delay in diagnoses and treatment<sup>25</sup>.

In the present study, in addition to the antidiabetic the class of medicines prescribed to the patients was also monitored (Figure I).

Which assures the prevalence of various infections in association with hyperglycemia. Interestingly other than antihypertensive, antibiotics were found with the maximum prescribing frequency which is indicative of high correlation of infection with hyperglycemic condition and outcome stands on the fact that the condition is accountable for frequent episodes of infection mostly bacterial. As the high level of glucose in blood favours the pathogenicity, protein kinase C is found to be activated in a high glucose level that is accountable for inhibiting the neutrophil activity and phagocytosis and pathogen develop infections promptly<sup>1&26</sup>. Mostly the physicians believe that diabetic individuals are subjected to infections that results in complications in controlling diabetes and unfortunately despite of recent advances in the management of both diabetes and infectious diseases, patients remain at increased risk of infection as nerve damage and reduced blood flow to the extremities, increase the body's vulnerability to infection consequently the risk of all type of infection studied was higher among patients with diabetes.

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## Conclusion

The recommendation of necessary immunization with vaccines has become essential as a consequence of high risk of infection in diabetic patients regarding careful evaluation. Further the studies reveals higher risk of hospitalization for the diabetic patients due to bacterial infection. However this is the responsibility of physicians and community pharmacist to play their role in making population aware about the facts related to diabetes and to treat and address the infections at earlier and prior to that become chronic with proper timely vaccination.

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## Conflicts of Interest

None.

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