

# Prevalence of Unknown Hyperglycemia in Oral Surgery Patients in Dental Clinics

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**Abstract** Hyperglycemia is a condition in which an excessive amount of glucose circulate in the blood plasma. This condition could have severe repercussions in the healing processes and exacerbate preexisting and future conditions such as periodontic or vascular related. Therefore, it is vital for the dental professional to know the glycemic indexes of their patients; however, it is not a common practice, in addition, in Mexico it's not common practice for patients to know their own glycemic rages, this could lead to prolonged bleeding, long healing times and vascular consequences. In this research we evaluated the glycemic indexes of 100 patients with no previous knowledge or suspicious of diabetes or hyperglycemia using two methods of evaluation, glucometer and laboratory test. The result showed that 19% of the patients exhibited diabetic levels of hyperglycemia and didn't know about it, proving the importance of knowing the patients' glycemic indexes by any method to assure improved integral treatment dental clinics.

**Keywords:** *hyperglycemia, diabetes prevalence, preventive dentistry*

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## 1. Introduction

Hyperglycemia is a condition in which an excessive amount of glucose circulate in blood plasma, and it has been recognized as a proximal etiopathogenic trigger of biochemical and cellular disorders, in the beginnings or the progression. [1] According to the American Diabetes Association (ADA), fasted glycemic levels can be as high as 100 mg/dL to be recognized as normal between 100 and 125 mg/dL to be recognized as Impaired Glucose Tolerance (IGT), also recognized as prediabetes, and in levels of 126 mg/dL or higher, the patient is considered hyperglycemic and generally indicates diabetes. Diabetes, also called diabetes mellitus, is a group of metabolic disorders, it's chronic, complex and multifactorial heterogenous syndrome characterized by the abnormalities in glucose metabolism. [2] Its physiopathology is caused by an absolute or partial alteration in insulin pancreatic secretion or its activity in the cell response to it. Insulin is the hormone responsible for helping glucose obtained by the feeding get into cells to be used for energy, an excess of it, generates an unbalance in glycemic levels and leads to many health complications. [3]

There are a number of reasons that can modify glycemic levels other than glycemic dysmetabolism, c.a. psychological stress, [4] aggressive metabolic response to lesions, [5] or drug induced sugar spike (such as

glucocorticoids or catecholamines). [6] This hyperglycemia causes can be due to overexpression of stress hormones (up to ten-fold) and neurotransmitters such as cortisol, epinephrine and norepinephrine, manly the neuroendocrine response is characterized by gluconeogenesis and glycogenolysis signaling and/or insulin resistance (due to insulin receptors blockage), aimed at restoring homeostasis and allowing the host to survive long periods of stress. [7] The hyperglycemic path, when sustained, has a variety of consequences such as abnormal blood flow, increased vascular permeability, angiogenesis, capillary occlusion, electrolytical alterations, brain ischemia, increasing healing time, among others. [8] When presented, it can produce a variety of consequences in patients, to give an example, high blood glycemic levels are associated with an increase in mortality rates in burned, trauma, surgery, cerebrovascular o acute coronary syndrome cases. [9]

Chronic or uncontrolled hyperglycemic levels above 126mg/dL are recognized as diabetes type 2. It's a chronic, complex and multifactorial heterogenous syndrome characterized by the abnormalities in glucose metabolism. [10] The multi-system complication includes microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (ischemic heart disease, stroke, peripheral vascular disease) endpoints. [11] Therefor, diabetic or hyperglycemic patients present alterations in all healing phases such as hemostasia, chronic inflammation, micro- and macro- circulatory dysfunction, hypoxia, autonomic

and sensory neuropathy, impaired neuropeptide signaling, besides altered fibrinolysis, capillary obstruction, keratinocytes differentiation alteration and slow remodeling, that's why glycemic indexes evaluation are critical for an effective patient care, either on dental patients or in general health care. [12].

Usually hyperglycemic symptoms, regardless of the severity of the glycemic level, can be mild, confusing, and in some cases, be unnoted by patients. Some of the symptoms that do exhibit are frequent urination, thirst, blurred vision, fatigue, and recurring infections, which can be confused with other pathologies or ignored. [13] For that reason, it's easy to dismiss any hyperglycemia to an uneducated or inattentive person. Therefore, it's possible to find this condition is unaware patients, which can create a variety of complications an increase mortality raise, so it has to be considered seriously as an important risk factor. [14,15]

As in medical treatments, any hyperglycemia level in dental treatment can represent possible complications, and as a consequence its necessary to consider it to minimize intraoperative emergencies risks and reduce possible complications specially in unknowing patients, for that reason, hyperglycemia's indicative signs and symptoms must be checked pre-treatment, and adjust accordingly to avoid its possible consequences. [16] Anesthetic technics must be used as atraumatic as possible to prevent patient stress situations that can induce cortisol and catecholamines rising. [17] Periodontal pathologies are the oral diseases that are more commonly observed in chronic hyperglycemia and diabetes, [18] but hyperglycemia originated complication can present in any dental procedure. For this reason, before starting the dental treatment is necessary to consider its presence to minimize the mentioned risk in intraoperative emergencies and reduce the complications possibilities. A complete anamnesis is necessary to know the diabetes presence, type, and treatment, the control frequencies, if hyper or hypoglycemic episodes have presented or any other complication fitting with diabetes and, ideally the onsite glycemic levels. [19] All patients systemically compromised have to be evaluated, taking in account individual characteristics to determine a correct treatment plan with the minimal risk possible. [20]

Although it is of interest to any healthcare provider, including dentists, to know the hypertensive and diabetes status of their patients for several reasons, glycemic levels screening is not routinely done in many dental procedures. This study aims to know the high glycemic levels prevalence of the patients that attend to a public university's dental clinic for oral surgery services, as well as recognize the importance of identifying patients with high risk of hyperglycemia consequence.

## 2. Methods

We used a cross and non-experimental design and evaluated a total of 79 dental surgery patients (exodontias, biopsies and soft tissue surgery). The patients evaluated were 51% male and 49% female and presented an age range as follows: 22% between 23 and 39 years old, 21% between 40 and 50 years old, 24% between 51 and 60

years old and 33% between 61 and 80 years old.

The American Diabetes Society standards were used to evaluate glycemic indexes status (normal: higher than 100 mg/dL; pre-diabetes: higher than 100 mg/dL and lower than 126 mg/dL; hyperglycemia or diabetes: higher than 126 mg/dL). The patients evaluated had no previous knowledge, medical diagnosis or treatment of hyperglycemia or diabetes attending to a public university's dental clinic, for oral surgery services. All patients were thoroughly informed about the surgical procedure, signed a consent form, in accordance with the ethical protocol, and were requested a glycemic index and general systemic condition report physician a day prior to the study. The patient's attention protocol consisted in the evaluation of presurgical fasted glycemic index.

Patients were recommended to be scheduled for appointments by morning in a fasted state and were scheduled to attend laboratory test to evaluate fasted glycemic levels on the day prior to the procedure and their onsite glycemic level were evaluated using a glucometer (Dexcom G6). Patients with glycemic indexes between 70-180 mg/dL could be attended and submitted to any dental procedure.

## 3. Results

The fasted glycemic indexes evaluations indicated that 68.4% of patients within normal levels, 12.7% considered pre-diabetes or with impaired glucose tolerance, from that percentage, 50% are male and 50% women (Figure 1). On the other hand, 19% of the patients exhibited hyperglycemic levels considered as diabetic, again unaware and undiagnosed, from which 73% are women and only 27% men; these results are consistent with Mexico's diabetes statistics of ~16% prevalence. [21]

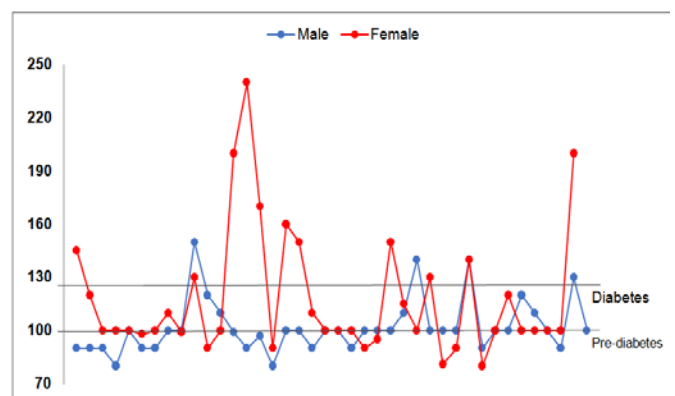


Figure 1. Patients laboratory glucose results

Using the glucometer method the results obtained were that 69.6% of the patients presented normal hyperglycemia, 19% within the pre-diabetic levels and 11.4% with hyperglycemia past the diabetic level, these results exhibit the same tendencies as de lab results, specially the significantly higher glycemic levels in female patients (Figure 2). However, both methods of evaluation presented a correlaton coefficient higher than 0.646, which means that there's a significant correlation between both measurement methods.

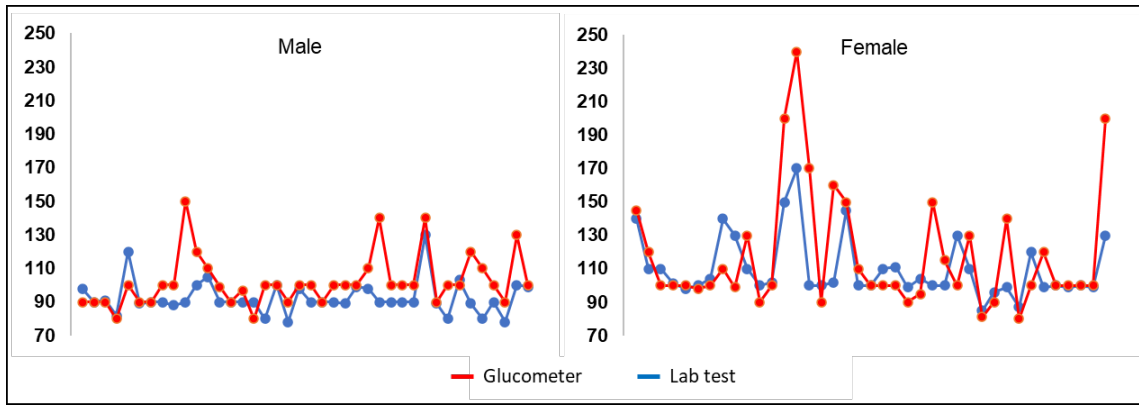


Figure 2. Glucose level evaluation method comparison by gender

Its important to mention that within the highest glycemic levels (past diabetic levels), 88.8% correspond to female patients and only 11.1% corresponde to male patients. Other remarkable result is that the mean diference between the glucometer and the lab test were lower on female patients and higher in male patients (Table 1), this result should be atributed to the hormonal status in correlation with the method but this need to be explored in future studies.

Table 1. Glucometer and laboratory tests global results

		n	Mean	$\sigma$	SEM
Glucometer	F	39	110.00	18.429	2.951
	M	40	92.58	10.056	1.590
Lab test	F	39	118.03	35.640	5.707
	M	40	102.15	15.463	2.445

#### 4. Discusion

From the results we can infer a clear tendency of hyperglycemia in women (Figure 1), this could be attributed to a physiological complication proper to this gender, educational level, socioeconomic level and cultural practices of selfless caretaking that lead a lot of Mexican women to neglect their health or their health concerning symptoms. [22] In agreement with the past statement there is a correlation of an increasing tendency between the individual patients result and the average (Table 1), mainly the female average was 118.02 and the male average was 102.15, significantly high and well past the pre-diabetes limit.

On the other hand, the glucometer evaluation was made on site, on the day of the oral treatment, this evaluation presented some discrepancies in comparison with the lab test, eventhough the tendencies were present. There are reports of serious discrepancies between glucometer results and the real blood glucose report from laboratory testing, [23] so this can explain the differences with the results. However, they can also be attributed to a difference in stress momentum, previous feeding, extended postprandial period or stress hormones unbalance. In spite of the discrepancies, the tendencies were similar, showing that the glucometer could be a valuable and critical evaluation tool for the dental office in patients with diabetes or hypergluciemia suspecion, and to avoid unnecesary consequences of the treatment or healing process. With no regard of the review method, women

presented more incidence of unaware hyperglycemia confirming the prior results.

On a closer look of the patients with unaware hyperglycemia, above 126 mg/dL (above diabetic levels), as mentioned before, they were mainly women, but the age distribution exhibited a higher frecyency in older patients male or female (Figure 3). Therefore, in consistency with the previous results, female patients' prevalence of huyepglycemia is higher than male's, and, in addition, age is an other risk factor to consider. Manly, as a result of this study women older than 41 years old present higher odds to present glycemic diregulation and thus, hyperglycemic consequences.

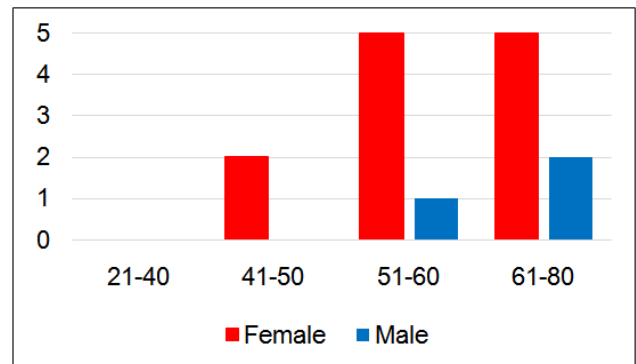


Figure 3. Prevalence of hyperglycemia above 126 mg/dL in patients by age and gender

As concluding remarks, dentists could play an important role in diabetes or hyperglycemia diagnostics, also, early manifestations of these conditions can affect the oral cavity, thus the importance of glycemic levels evaluation prior to oral treatment, there for, the glucometer measurements could represent an important primary tool in the dental office to improve the outcome in patients with possible diabetes. Besides, to be able to plan and evaluate the oral health services and focus educational programs for hyperglycemic or diabetic patients its necessary to know the prevalence in the local population and determine an oral treatment protocol accordingly to avoid complications. On this regard, 19% of the patients treated were unaware, undiagnosed hyperglycemic (diabetic) patients, this is consistent with Mexico's diabetes prevalence of ~16% [21]. This condition presented more frequently in older adults, especially among women suggesting a tendency to diabetes towards older women also consistent with Mexico's diabetes

statistics. However, this study didn't evaluate the results of the treatment or complication presented in relation with the hyperglycemic level of the patients; this represents an area of opportunity for future research. We can conclude that hyperglycemia evaluation should be acknowledged and implemented for diagnostic and prevention protocol in dental treatments in private practice as well as in educational clinics.

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