

Blood Glucose Concentration in Non-Diabetic Individuals Undergoing Dental Extraction: Comparison of Pre vs Post Extraction levels

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ABSTRACT

Objective: To compare pre and post surgical blood glucose levels in non diabetic healthy individuals undergoing dental extraction.

Study Design: Comparative analytical study.

Place and Duration of Study: Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Oct 2023 to Apr 2024.

Methodology: The study included 85 patients of 20 to 50 years of age presented for tooth extraction under local anesthesia. Patients were kept fasting for 10 to 12 hours before attending for tooth extraction. Pre surgical blood glucose levels were checked with blood glucose meter. Tooth extraction was carried out using anxiety reduction protocol and after completion of extraction procedure post surgical blood glucose levels were again checked with same device.

Results: The mean fasting time of participants before procedure was 10.7+1.03 hours. There was no difference in blood glucose level pre surgery mean 92.11+5.25 mg/dl to post surgery mean 91.86+5.62 mg/dl, out of 85 patients none of patient develop signs and symptoms of hypoglycemia during dental extraction.

Conclusion: Dental extraction under local anaesthesia can be carried out safely in fasting non diabetic healthy individuals. Dental surgeon must be fully aware of clinical signs and symptoms of hypoglycemia for its early recognition and must be well prepared to manage the patient in case of any such event.

Keywords: Blood Glucose Concentration, Diabetes Mellitus, Dental Extraction, Fasting Glucose Levels, Hypoglycemia Local Anesthesia.

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INTRODUCTION

Dental extractions are commonly performed oral surgical procedures under local anesthesia in outpatient setting. Several medical emergency situations may arise during dental extraction and one of the important medical emergency situations is occurrence of hypoglycemia in diabetic and non-diabetic patients.¹⁻³ Hypoglycemia in type 1 (Insulin dependent diabetes mellitus), and type 2 (Non insulin dependent diabetes mellitus) diabetics is more common owing to mismatch in insulin or hypoglycemic drugs and decreased caloric intake.^{4,5} Diabetic patients need special attention and a complete history of this metabolic disease (including pharmacological agents that are being used to treat this condition and hypoglycemia signs and symptoms that are being experienced by patient) is necessary before the patient undergoes dental extraction procedure. On the other hand hypoglycemia in non-diabetic individuals is less common during dental

extraction.⁶ Majority of patients with diabetes mellitus are well aware about their disease and are able to recognize their own hypoglycemia before it becomes severe. Clinical symptoms of low serum glucose concentration during dental extraction include; nausea, feeling of hunger, lightheadedness, change in mood, anxiety, perspiration, pallor, seizures and unconsciousness.⁷

Different studies^{8,9} show that serum glucose levels are affected after administration of local anesthetic for dental procedures. This change in blood sugar level after administration of dental local anesthesia containing adrenalin remains a subject of controversy in the studies carried out.

Hypoglycemic episode in non-diabetic healthy patients is relatively rare due to physiologic mechanism that regulates glucose concentration by enhancing glucose production.¹⁰ As healthy non-diabetic individuals requiring dental extraction are usually unaware of the clinical symptoms of hypoglycemia and many a times patients reporting for tooth extraction are fasting overnight there prevails a controversy that fasting patients are more prone to

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develop hypoglycemia during tooth extraction. In many cases these patients are being re-appointed or sent back to have dietary caloric intake before tooth extraction. It is therefore critical to identify hypoglycemic patient during dental procedure due to its potential adverse effects including coma, seizures, brain damage and / or death. On the other hand it is equally important to save patients from unnecessary delay in tooth extraction when they are suffering from severe odontogenic pain and swelling on the pretext of missing a meal/breakfast.

We carried out this comparative study to evaluate change in pre and post tooth extraction blood glucose levels in healthy non-diabetic individuals presented for tooth extraction with overnight fasting.

METHODOLOGY

This Comparative analytical study was conducted at Oral Surgery Department of Armed Forces Institute of Dentistry, Rawalpindi Pakistan from October 2023 to April 2024. Approval of ethical committee was obtained prior to start of study vide letter No. 918/Trg dated 13 May 2020.

Patients of both genders who reported for tooth extraction and fulfilling inclusion criteria were thoroughly evaluated with meticulous history and clinical examination. Patients were informed about study and consent obtained to include them in study population.

Inclusion Criteria: Healthy individuals of age range from 20 to 50 years with no history of diabetes mellitus and other metabolic disease or systemic illness requiring one or two teeth for extraction and willing to be reappointed as fasting on day of surgery, were included in study.

Exclusion Criteria: Known diabetic patients and patients having history of other metabolic disease or systemic illness, patients younger than 20 years or elder than 50 years, patients unwilling to be reappointed for extraction as fasting, pregnant female patients and lactating mothers were excluded from study. Also patients with fasting blood glucose levels of lesser than 70mg/dl or greater than 100mg/dl were excluded from study.

Fasting blood glucose level of all patients selected for study was checked before extraction after obtaining finger blood sample with "Blood Glucose Meter" (On Call EZ II, ACON Laboratories, Inc. 5850 Oberlin Drive, #340 San Diego, CA 92121, USA) and recorded. Tooth extraction procedure was done for all patients as indicated for dental extraction under local

anesthesia (lignocaine with adrenalin). Anxiety reduction protocol was followed to reduce procedure related anxiety for all patients. Total procedure time from administration of Local anesthesia injection to completion of tooth extraction was recorded and after completion of tooth extraction post surgical blood glucose levels were again checked using same blood glucose meter. A pre designed proforma was filled for each individual. Any untoward event if happened was also recorded.

Data was analyzed using Statistical Package for Social Sciences version 24. Frequencies and percentages were calculated for qualitative data while mean and standard deviation were calculated for quantitative variables like patients fasting time and total procedure time. Paired samples t test was used for Comparison of pre and post extraction blood glucose concentration. The p value ≤ 0.05 was considered as significant.

RESULTS

This study constitutes 85 participants of the age range 21 to 50 years that were divided into six equal groups (Figure-1). Out of 85 participants 52(61.2%) were males and 33(38.8%) were females. The mean fasting time of participants before we checked blood glucose levels was 10.7 $\pm$ 1.03 hours. Total procedure time that is also the time before we checked post surgical blood glucose level is as shown in Figure-2. The comparison of pre and post blood glucose concentration explained in Table.

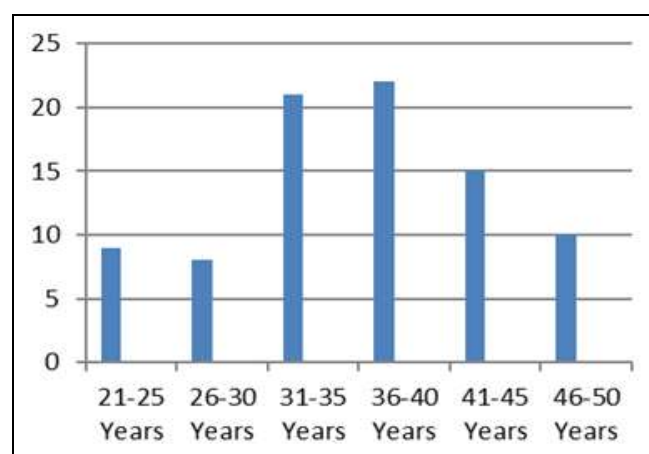


Figure-1: Distribution of patients according to age groups

DISCUSSION

Hypoglycemia is a condition in which plasma glucose levels drops below 70mg/dl, however clinical

signs and symptoms of hypoglycemia occurs when plasma glucose levels drops below 55mg/dl.¹¹ Under physiologic conditions the primary metabolic fuel for the brain is glucose and it requires a constant arterial glucose supply for adequate metabolic functions as its own tissue is very limited in supplying glucose. Gluconeogenesis (Non carbohydrate source of glucose) and glucogenolysis (breakdown of stored glycogen into glucose) in the liver maintains serum glucose levels during fasting period.¹² In an study carried out by Sekine M *et al.*,¹³ there was no effect of adrenaline containing local anaesthesia on pre and post extraction readings and this may be because they also used intravenous sedation in their patients that reduced the stress induced release of cortisol that causes a slight increase in blood glucose levels in out patients. In most of cases hypoglycemia occurs in known and diagnosed diabetic cases who are undergoing pharmacologic intervention, and among these, patients having type 1 (insulin dependent) diabetic mellitus are three times more prone to experience hypoglycemic event than type 2 (non insulin dependent) diabetic mellitus who are taking oral hypoglycemic drugs.¹⁴ Many of diabetic patients are well aware of common clinical signs and symptoms of hypoglycemia and they can detect their own hypoglycemic event early before it becomes severe and also its easy for dental surgeon to detect symptoms of these patients as he or she is aware about the disease of patient and take protocols to prevent hypoglycemia during dental surgical procedures. Hypoglycemia in non diabetic healthy patients is uncommon,¹⁵ but when it occurs there are a few major etiological factors of it including; malnutrition, history of alcohol consumption, counter regulatory hormone deficiency, non - islet cell tumor, end stage liver disease, starvation, sepsis and use of certain pharmacologic agents.¹⁶

A study carried out by Haji *et al.*,¹⁷ on blood glucose concentration in diabetes patients who are undergoing tooth extraction under local anesthesia stated a statistically significant difference in the mean blood glucose concentration between the two groups. This could be because they have conducted their study in diabetic patients who are using pharmacological agents for the diabetes and the use of these hypoglycemic agents pre operatively by patient may have affected blood glucose levels.

Another study carried out by Kamal Qaranizade *et al.*,¹⁸ to evaluate change in serum blood glucose

levels during teeth extraction under local anesthesia concluded that blood glucose levels increased after injection of local anaesthetic agent for dental extraction. In this study author did not stated that about study population that whether they were diabetics or non diabetics.

In a number of other studies^{10,11} it has been revealed that local anesthetic administration can increase norepinephrine in blood but there is a slight increase related to the severity and extension of the dental surgical procedure. The blood glucose level is related to the epinephrine plasmalevels and is different from norepinephrine secreted by the sympathetic system. An increased blood glucose level is observed in the presence of epinephrine in local anesthetic materials. Epinephrine has gluconeogenic hormonal activity. Following epinephrine containing local anesthetic injection, blood glucose levels increased rapidly during 15 min and come again to the baseline after 2 hours.

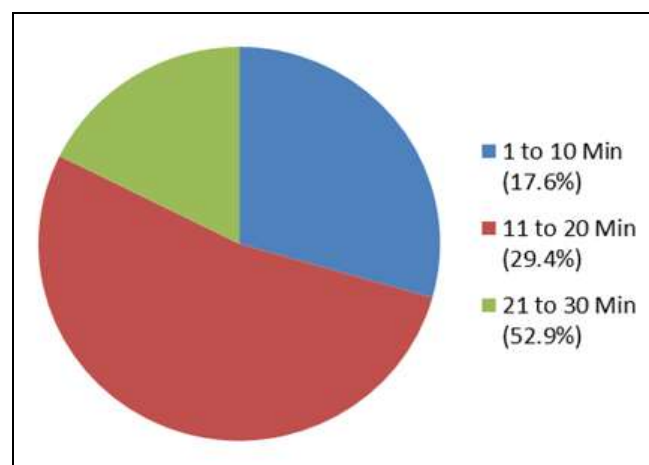


Figure-2: Distribution of Patients according to Procedure Time

Table: Comparison of pre and post extraction blood glucose concentration

Blood Glucose concentration mg/dl	Pre-Surgical (n=85)	Post-Surgical (n=85)	p-value
	92.11±5.25	91.86±5.62	< 0.001

Bortoluzzi *et al.*,¹⁹ included 37 Brazilian patients in their study to evaluate hemodynamic and glucose measurement alteration in patients who received a local anesthetic containing a vasoconstrictor (LAVA; 2% mepivacaine with adrenaline 1100,000). They reported that their assessed features, including systolic and diastolic blood pressure, heart rate, and glucose levels, have no considerable changes in healthy individuals.

In our study we evaluated effects of dental extraction procedure on patient's blood glucose concentration. None of our patients develop sign and symptoms of hypoglycemia when they underwent dental extraction procedure after 8 to 12 hours of fasting and in many cases post surgical plasma glucose levels was on slightly increased side. This could be because of glycogenolysis and gluconeogenesis that contributed to maintain glycemic levels when required. It is stated by Sharon Aronoviche *et al.*,²⁰ in their study that it is well known factor that surgical stress causes increased in blood glucose concentration (Hyperglycemia) through the release of various hormones (catecholamines, glucocorticoids, growth hormone, and glucagon) and inflammatory cytokines (tumor necrosis factor, interleukin 1, and interleukin 6), thus increasing blood glucose levels in patients with already poor glycemic control.

CONCLUSION

Dental extraction and minor oral surgical procedures under local anesthesia can be done safely in fasting non diabetic healthy individuals and the procedure should not be delayed on the pretext that patient did not had meal and is fasting for 10 to 12 hours. However dental surgeon must be fully aware of clinical signs and symptoms of hypoglycemia for its early recognition and must differentiate it from common syncope episode. Also dental surgeon must be well prepared to manage the patient in case of any such event.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AB & SUK: Data acquisition, data analysis, critical review, approval of the final version to be published.

SJHB & AAK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MA & IK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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