



Comparison of Random Blood Sugar and pH of Blood- A Clinicopathological Study

P. Titus Lalith Antony^a, Palati Sinduja^{a#†} and R. Priyadarshini^{b#†}

^a Department of Pathology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai 77, Tamil Nadu, India.

^b Department of Pathology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Tamil Nadu, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i57B34060

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/77540>

Original Research Article

Received 06 October 2021
Accepted 12 December 2021
Published 14 December 2021

ABSTRACT

Aim: This study aims to compare the random blood sugar pH of the blood.

Introduction: Hyperglycemia is a risk factor for the impairment of periodontal health while periodontal disease, in turn, is responsible for the adverse effects on glycemic control and the pathophysiology of diabetes-related complications. An increase in blood sugar levels has a direct effect on pH with respect to age. Hence this study deals with the association of random blood sugar levels and pH with age, gender, and dental complaints.

Materials and Methods: 20 random blood samples were collected from the patients in Saveetha Dental College. The random blood sugar level was analyzed by the semi-quantitative method and the pH was analyzed by using a multi reagent strip. And the results were statistically analyzed using SPSS software and represented as pie charts and bar graphs.

Results and Discussion: The overall mean value of RBS and blood pH was found to be 138.4 mg/dl and 7.06 respectively. The mean RBS value is higher in the 41-50 years age group of people than in other age categories and the mean pH value is same for all age categories. In the present study, samples with periodontic complaints have higher mean value of RBS values (193) than other dental complaints and the mean pH value is same for all dental complaints.

[†] Dr.;

[#] Assistant Professor;

^{*}Corresponding author: E-mail: sindujap.sdc@saveetha.com;

Conclusion: Within the limits of the study, it can be observed that there is a significant association between the age group, gender, and dental complaints with RBS and pH of the patients. However, further studies must be conducted to have more accurate results and elicit the association between pH and RBS with age and gender.

Keywords: Random blood sugar; Blood pH; Dental complaints; Hyperglycemia; innovative technique.

1. INTRODUCTION

pH is a key criterion for evaluating body homeostasis. Hemoglobin and albumin are high pH buffering molecules in the blood, and the pH of blood remains around 7.35 and 7.45 on the pH scale [1,2]. Disturbance of the mechanisms which maintain normal blood pH is a defining feature of diabetic ketoacidosis (DKA), an acute and life-threatening complication of the chronic metabolic disease, diabetes [3,4], and Hyperglycemia. A complex synergy of action involving the lungs, kidneys, and the blood's bicarbonate buffering system maintains the pH of blood (ECF) within very narrow limits (7.35-7.45) [5,6].

Normal metabolism is associated with continuous production of hydrogen ions (H⁺) which tend to reduce pH, but bicarbonate in the blood (ECF) combines with these hydrogen ions forming carbonic acid. CO₂ is eliminated from the body by the lungs and bicarbonate is regenerated in the kidneys. By this means, the concentration of hydrogen ions in the blood, and therefore the pH, remains constant despite the continuous production of metabolic acids [7,8]. The abnormal accumulation of ketoacids in the blood that occurs in DKA overwhelms this buffering system. In the process of DKA, pH is less because the bicarbonate buffer is exhausted, i.e. bicarbonate concentration is reduced. So the compensatory mechanism invoked by DKA is increased respiration [9-11]. Kussmaul's respiration, in patients suffering from DKA [12,13], provides clinical evidence of the compensatory mechanism for blood pH. The decreased pCO₂ that results from this increased respiration returns the pH towards normal but may not be sufficient to achieve a normal pH [14-16]. The patient is fully compensated if the blood pH is within the normal range or partially compensated if the blood pH remains below the lower limit of the normal values [12,17]. The

three main components of DKA treatment are insulin administration, replacement of lost fluid with an intravenous injection of isotonic saline, and replacement of potassium losses [18]. Bicarbonate infusion is often used to deal with acidosis correction [19,20].

Careful and intensive monitoring of blood biochemistry (particularly blood glucose, potassium, and pH) and fluid balance is essential for a favorable outcome [21-23]. Our team has extensive knowledge and research experience that has translated into high quality publications [13],[2,4,6,10,12,16,19,24-30], [31-35].

Hence, the study aims to compare the Random Blood Sugar levels and pH of blood among the population.

2. MATERIALS AND METHODS

Random blood samples [20] were collected from the patients in Saveetha Dental College and the low sample size is one of the limitations in this study. The Random blood sugar for the 20 samples was determined by a semi-quantitative method using the strip method as it is commonly available and user-friendly. The blood pH was analyzed from the samples using a multi-reagent strip and the pH was determined. The pH and RBS of the patients were tabulated and were statistically analyzed using SPSS software version (23.0) and represented as pie charts and bar graphs [34]. A correlation test was done to check the association between RBS and pH with Gender, age group, and dental complaints.

3. RESULTS AND DISCUSSION

The following graphs indicate the correlation between RBS and pH with Gender, age group, and dental complaints.

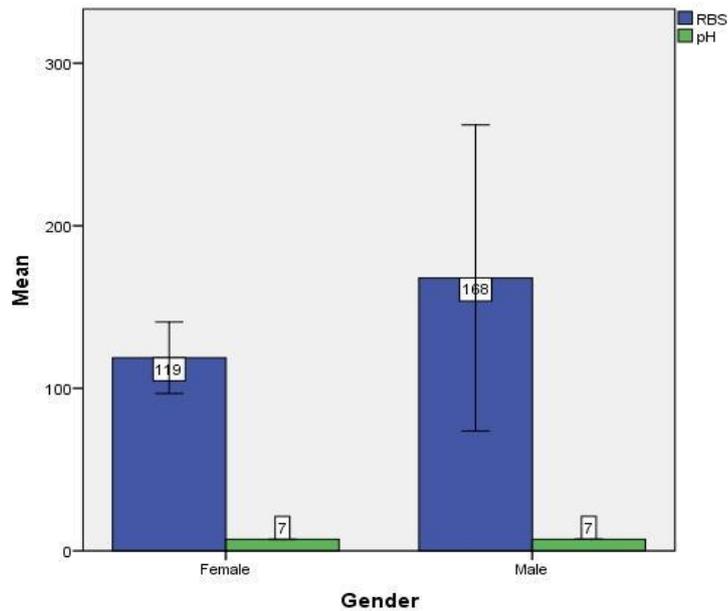


Fig. 1. Bar graph represents the correlation between RBS and pH with the Gender. The X-axis represents the gender, and the Y-axis represents the mean value of RBS and pH. The green color represents pH, and the blue color represents RBS. It is analyzed that the mean RBS value is higher in males than females and the mean pH value is the same for males and females. A correlation test was done, and the association was found to be statistically significant with Pearson's correlation value ($r = 1$)

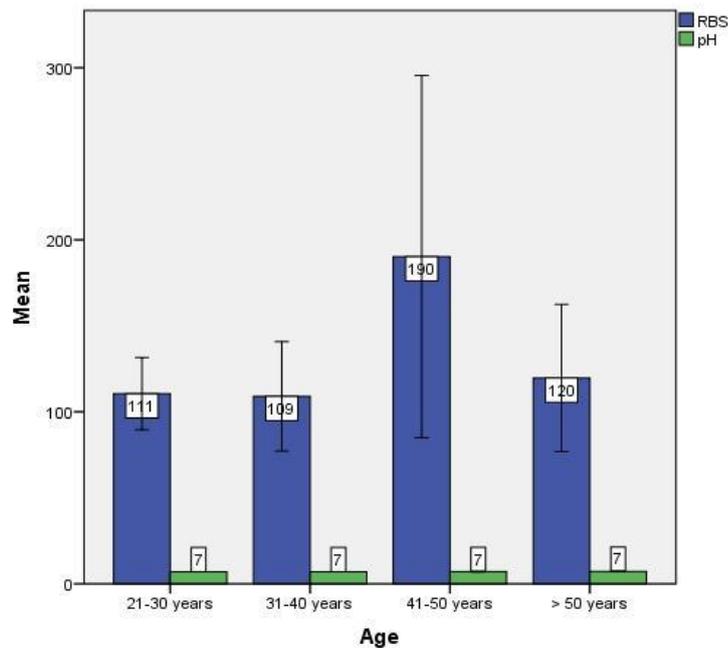


Fig. 2. Bar graph represents the correlation between RBS and pH with age. The X-axis represents the age, and the Y-axis represents the mean value of RBS and pH. The green color represents pH, and the blue color represents RBS. It is analyzed that the mean RBS value is higher in the 41-50 years age group of people than in other age categories and the mean pH value is same for all age categories. Pearson's correlation test was done, and the association was found to be statistically significant with Pearson's correlation value of ($r = 1$)

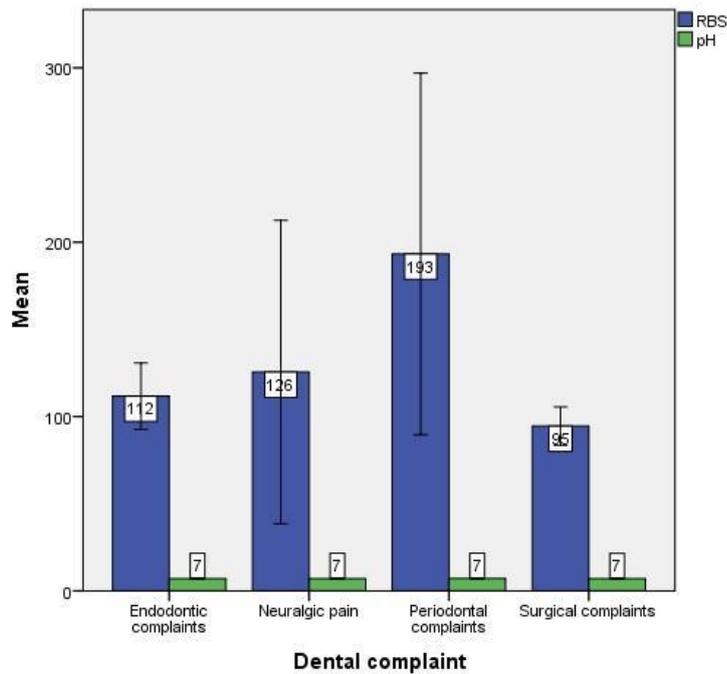


Fig. 3. Bar graph represents the correlation between RBS and pH with the dental complaints. The X-axis represents the dental complaints, and the Y-axis represents the mean value of RBS and pH. The green color represents pH and the blue color represents RBS. Samples with periodontic complaints have higher mean value of RBS values (193) than other dental complaints and the mean pH value is same for all dental complaints. Pearson’s correlation test was done, and the association was found to be statistically significant with Pearson’s correlation value of (r=1)

In our study, it was found that 5 (25%) of the study population were aged between 21-30 years, 5 (25%) of them between 31-40 years, 5 (25%) of them between 41-50 years and the remaining 5 (25%) of the study population were above 50 years. Gender distribution shown in this study was 8 (40%) males and 12 (60%) females. The study population showed 6 (40%) out of 20 with endodontic complaints, 5 (33%) with periodontal complaints, 5 (13%) with surgical complaints, 4 (13%) with neuralgic pain. The Random Blood Sugar value and pH of the blood were calculated for all the participants and that showed an overall mean value of RBS and blood pH was found to be 138.4 mg/dl and 7.06 respectively.

The mean pH for the age group between 21-30 years was 7.0, between 31-40 years was 7.0, the age group between 41-50 years was 7.13, and the mean pH of the age group more than 50 years was 7.10. Results of this study show that blood pH values are positively correlated with the age group (r=1). The mean value of pH was almost same in all the age groups. It showed that when the age group increases the pH of the

blood also slightly moves towards a higher end. In the present study, the mean value of pH was almost equal both in males and females. In a previous study with similar findings, RBS, and the prevalence of glycosuria among men were much higher than females with respect to glucose tolerance tests [36–38].

In the case of dental complaints, the mean value of RBS was higher in the 41-50-year-old age group (190 mg/dl) when compared to the other age groups. The mean value of RBS was higher (168 mg/dl) in males when compared to females (119 mg/dl). With respect to dental complaints in the present study, the mean value of RBS for periodontic complaints, neuralgic pain, endodontic complaints, and surgical complaints were 193mg/dl, 126 mg/dl, 112 mg/dl, and 95 mg/dl respectively. In a study performed by K almas et al.2001, the subjects who had high random blood sugar levels were compared against their Community Periodontal Index of Treatment Needs score(CPITN) score and the results showed that periodontal disease severity was high among subjects who had high RBS levels than the rest of the subjects. The mean

CPITN score was then compared with the mean RBS level and the severity of periodontal disease present. There was a steady increase in the RBS level with an increase in CPITN scores, i.e., CPITN score was found to be 13.5 to 19.12 with the RBS values of 184.2 and 199.12 mg/dl among patients who had comparatively high RBS [31,35,39]. iuuoh

It can be observed that the mean value of RBS was comparatively higher in case of periodontal problems in males between the age group of 41-50 years which is in accordance with studies that suggests hyperglycemia as a risk factor for the impairment of periodontal health while periodontal disease [40–42], in turn, is responsible for the adverse effects on glycemic control and the pathophysiology of diabetes-related complications [18,33,43].

Limitations of this study include the less sample size and the other parameters which affect the pH were not considered. Future studies may be done to overcome these limitations.

4. CONCLUSION

Within the limits of the study, it can be observed that there is a significant association between the age group, gender, and dental complaints with RBS and pH of the patients. This observational study between RBS and pH has shown no difference in pH observed. The average mean value for RBS is 138.4mg/dl and for pH is 7.06. However, further studies have to be conducted to have more accurate results and elicit the association between pH and RBS with age and gender.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s)

ACKNOWLEDGEMENT

The authors are thankful to Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College and Hospitals, Saveetha

University for giving a platform to conduct the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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