STUDY OF ALBUMIN LEVELS IN SALIVA OF DIABETES MELLITUS PATIENTS WITH PULMONARY TUBERCULOSIS

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ABSTRACT

Background: Insulin deficiency and/or insulin resistance experienced by patients with DM are known to trigger hypoalbuminemia. Studies have stated the relationship between serum albumin levels and the prediction, prognosis and complications of DM, as well as in TB where albumin is a marker of nutritional status. From the results of the study it is hoped that it will be able to see a comparison of salivary albumin levels with serum in patients with DM-TB, DM, and controls. As well as knowing whether saliva have the potential to be an alternative prognosis marker in DM patients with TB.
Method: Analytical research was designed using observational methods with a case control approach. 50 respondents who were distinguished based on the status of the respondents.
Result: The results of the examination of saliva and serum specimens showed significant differences in albumin levels from either the DM-TB, DM, or Control groups (P-Value <0.05). In contrast to serum albumin which has decreased, salivary albumin levels were identified to have increased in DM cases. Where salivary albumin levels in the DM-TB group had the largest mean value compared to the DM and Control groups. This indicates a poor prognosis in patients with DM-TB when compared to other respondent groups.
Conclusion: The mean salivary albumin level was found to be greater in the DM-TB group than the other two groups of respondents. This suggests lower salivary albumin has the potential to indicate the prognosis of DM-TB disease.

Keywords: Salivary; Albumin; DM-TB; DM

INTRODUCTION

Diabetes mellitus (DM) is a non-communicable degenerative disease that is ranked as the number one cause of death worldwide (IDF, 2021). Conditions of insulin deficiency and/or insulin resistance experienced by people with DM can result in decreased albumin synthesis and secretion, resulting in hypoalbuminemia, namely low albumin levels in the blood (Chen et al., 2016). One study found that 72.6% of respondents who were DM patients were identified as experiencing hypoalbuminemia (Gaputri & Pangalila, 2020). So that several other studies have also stated the relationship between serum albumin levels with prediction, prognosis and complications of DM.

In addition to blood, research related to the use of saliva as an alternative biological specimen for laboratory examination continues to be developed. As a specimen that is easy to collect and non-invasive, saliva can monitor changes that occur in pathological conditions (Kasuma, 2015; Zhang et al., 2016). Therefore, it is thought that saliva can be a potential alternative specimen for protein examination including albumin levels in patients with DM. However, in contrast to blood albumin levels which were found to decrease in DM cases, albumin levels in saliva were actually identified to have increased (Fouani et al., 2021).

The facts in the field show that the high incidence of DM is in line with the increased risk of tuberculosis disease. In TB disease, albumin levels themselves are used as markers of nutritional status and are related to the prognosis and mortality of patients. The results of research by Umam et al., (2017) showed that 72% of TB patients experienced hypoalbuminemia and poor clinical improvement.

Although there are currently no publications related to albumin levels in patients with DM who experience TB infection. However, the fact is that albumin levels are related to the condition of insulin resistance of people with DM and are a marker of the nutritional status of people with TB. So in the DM-TB group, albumin levels are assumed to be a potential prognostic marker. This underlies the research designed, from the results of the study it is hoped that it will be able to see a comparison of salivary albumin levels with serum in patients with DM-TB, DM, and controls. As well as knowing whether saliva samples have the potential to be an alternative prognostic marker in DM patients with TB.

METHODS

Analytical research was designed using observational methods with a case control approach. The research was conducted in April-June 2024 with a research population of type 2 DM patients based on the status of respondents, namely DM-TB, DM, and control groups totaling 50 respondents. Sampling was carried out in the Jambi City Region using convenience sampling technique while the examination of albumin levels was carried out at the Clinical Chemistry Laboratory, Department of Medical Laboratory Technology, Health Polytechinc Jambi. The data were analyzed bivariately to analyze salivary and serum albumin levels in patients with DM based on the status of the respondent then continued with a diagnostic test to determine whether salivary albumin levels can be an alternative prognosis marker in DM patients with TB.

RESULTS AND DISCUSSION

Research on patients with type 2 diabetes mellitus was conducted in April-June 2024. The study sample size was calculated using the OpenEpi application with an OR of 0.67 and a confidence level of 95% so that a sample size of 50 people was obtained. The research sample consisted of 20 patients with DM who suffered from pulmonary TB (DM-TB), 15 patients with diabetes mellitus (DM), and 15 healthy individuals. The characteristics of the research respondents were analyzed based on several criteria. Based on gender, the majority of research respondents were female (52%) and 58% of research respondents were identified as ≥45 years old.

Basically, gender does not affect the risk of a person suffering from DM but rather lifestyle, genetic inheritance and nutritional factors, but research states that women's body mass index, which is on average higher than men, increases the risk of DM disease (Abadi & Tahiruddin, 2020; Ciarambino et al., 2022). The majority of the study respondents were known to be ≥45 years old. At this age, the risk of DM disease is greater, this is related to an increase in glucose intolerance where there is a decrease in insulin sensitivity and body function towards glucose metabolic activity (Komariah & Rahayu, 2020; Ningsih et al., 2023).

1. Albumin levels in patients with DM based on respondent status

Normality tests were carried out on saliva and serum albumin levels in the three groups of respondents previously through the Kolmogorov-Smirnov test. From the data normality test, it was found that the data on serum and saliva levels in the three groups of respondents were normally distributed (P-value> 0.05).

Table 1. Comparison of albumin levels based on respondent status

Albumin levels (g/dL)		N	Mean	Median (IQR)	P-Value
Saliva	DM-TB	20	2,60	2,73 (1,22)	
	DM	15	2,25	2,26 (1,32)	0,007
	Kontrol	15	1,70	1,37 (1,27)	
Serum	DM-TB	20	3,22	3,38 (0,58)	
	DM	15	3,52	3,46 (0,48)	<0,001
	Kontrol	15	3,74	3,83 (0,34)	

The results of the analysis of salivary albumin levels obtained a P-Value = 0.07

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while the P-Value = <0.001 was obtained from the analysis of serum albumin levels based on the respondent's status. The results of the examination of saliva and serum specimens showed significant differences in albumin levels from either the DM-TB, DM, or Control groups. The results of the examination with serum specimens showed that the average albumin level of the DM-TB group was below the normal value range. While in the DM and Control groups, serum albumin levels are still in the normal range. However, currently the albumin levels of saliva specimens cannot be classified based on the normal range of values.

Clinically, people with DM are prone to hypoalbuminemia, namely low levels of albumin in the blood. This event is related to decreased albumin synthesis and secretion due to insulin deficiency and / or insulin resistance experienced (Chen et al., 2016). (Gaputri & Pangalila (2020) found that 72.6% of DM patients in their study experienced hypoalbuminemia. Likewise, in cases of DM-TB, where inflammatory cytokines released during TB infection will reduce albumin production, triggering hypoalbuminemia (Ganesan & Gopinath, 2019).
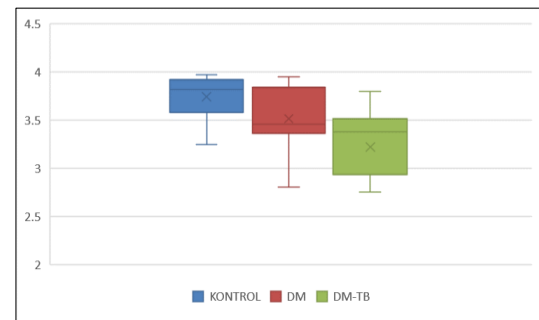
In contrast to serum albumin which has decreased, salivary albumin levels are known to increase in DM cases (Vaziri et al., 2009). The results of this study are in line with previous studies which showed a significant increase in salivary albumin levels in DM patients compared to controls (Aziz et al., 2016; Nirmala & Sultana, 2021).

2. Potential of salivary albumin level as a marker of prognosis for patients with DM-TB

Saliva is one of the potential biological markers ranging from biochemical changes, DNA, RNA, and proteins. With a safe and painless collection procedure, saliva is an alternative specimen for the diagnosis and prognosis of diseases such as diabetes

mellitus and other systemic disorders (Cenzato et al., 2023; Kasuma, 2015).

Currently, there are no publications regarding the range of normal values for saliva specimens so that the results of salivary albumin examination cannot be classified based on normal values. However, the results of the examination of saliva

specimens have significant differences in albumin levels from either the DM-TB, DM, or Control groups.

Figure 1. Serum Albumin Levels

In contrast to serum albumin which has decreased, salivary albumin levels have actually been identified as increasing in DM cases (Vaziri et al., 2009). Salivary albumin levels were found in the control and DM groups which had a smaller average value when compared to the DM-TB group which had the largest average value. This is in accordance with the theory that albumin in the oral cavity is considered an ultra-filtrate of serum into the mouth and can diffuse into
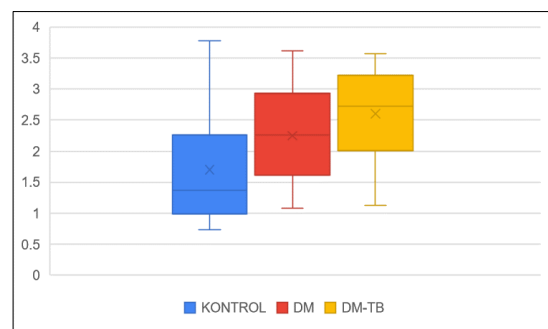
mucosal secretions.

Figure 2. Salivary Albumin Levels

Hyperglycemia that occurs can cause chronic oxidative stress which stimulates excessive production of reactive oxygen species (ROS) resulting in dysfunction in the salivary glands (Fouani et al., 2021). This

condition will cause leakage of serum proteins into the saliva so that patients with DM-TB can detect albumin levels in saliva (Andjelski-Radicevic et al., 2012; Fouani et al., 2021).

Based on this description, the results of salivary albumin examination are indeed proven to be able to distinguish research respondents based on the prognosis of the disease suffered. Where in this study salivary albumin in the DM-TB group had the largest mean value indicating a poor prognosis compared to other respondent groups. However, further research is needed to determine the potential of saliva as a marker of disease prognosis related to the sensitivity and specificity of salivary albumin in patients with DM-TB.

CONCLUSION

Salivary albumin can differentiate research respondents based on the prognosis of the disease suffered. This is supported by the average salivary albumin level found more in the DM-TB group than the other two respondent groups.

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CONFLICT OF INTEREST

The author declares there is no conflict of interest.

REFERENCES

Abadi, E., & Tahiruddin. (2020). Indeks Massa Tubuh (IMT) Penderita Diabetes Mellitus Tipe 2 di Puskesmas Poasia Kota Kendari. *Jurnal Kesehatan Masyarakat Celebes*, *1*(03), 1–6.

Andjelski-Radicevic, B., Dozic, R., Todorovic, T., & Dozic, I. (2012). Biochemical markers in saliva of patients with diabetes mellitus. *Stomatoloski Glasnik Srbije*, *59*(4), 198–204. https://doi.org/10.2298/sgs1204198a

Aziz, R. A. A., Mahrous, D. M., Mohammed, G. B., El-Rehem, S. R. A., & El-Wahab, I. A. A. (2016). Estimation of Salivary Glucose , Total Proteins , and Albumin in Children with Type 1 Diabetes Mellitus. *Journal of Medical Science and Clinical Research*, *04*(10), 13163–13170. https://doi.org/https://dx.doi.org/10.18535/jmscr/v4i10.60

Cenzato, N., Cazzaniga, F., Maspero, C., & Tartaglia, G. M. (2023). SALIVA-based diagnostic approach for diabetes mellitus : a step towards non-invasive detection – a scoping review. *European Review for Medical and Pharmacological Sciences*, 12080–12087.

Chen, Q., Lu, M., Monks, B. R., & Birnbaum, M. J. (2016). Insulin is required to maintain albumin expression by inhibiting forkhead box O1 protein. *Journal of Biological Chemistry*, *291*(5), 2371–2378. https://doi.org/10.1074/jbc.M115.677351

Ciarambino, T., Crispino, P., Leto, G., Mastrolorenzo, E., Para, O., & Giordano, M. (2022). Influence of Gender in Diabetes Mellitus and Its Complication. *International Journal of Molecular Sciences*, 1–13.

Fouani, M., Basset, C. A., Jurjus, A. R., Giovanna, L., Giovanni, L., Leone, A., & Leone, A. (2021). Salivary gland proteins alterations in the diabetic milieu. *Journal of Molecular Histology*, 893–904. https://doi.org/10.1007/s10735-021-09999-5

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Ganesan, H., & Gopinath, P. (2019). Prevalence of hypoalbuminemia among tuberculosis patients receiving anti tuberculosis therapy: A cross sectional study. *International Journal of Advanced Biochemistry Research*, *3*(2), 09–13. https://doi.org/10.33545/26174693.2019.v3.i2a.34

Gaputri, F., & Pangalila, F. (2020). Hubungan kadar albumin dengan Hba1c pada pasien diabetes mellitus tipe 2 di Rumah Sakit Royal Taruma Jakarta Barat periode tahun 2018-2019. *Tarumanagara Medical Journal*, *2*(1), 59–63. https://doi.org/10.24912/tmj.v2i2.7838

IDF. (2021). IDF Diabetes Atlas 10TH edition. In *International Diabetes Federation*. https://doi.org/10.1016/j.diabres.2013.10.013

Kasuma, N. (2015). Fisiologi dan Patologi Saliva. In *Andalas University Press* (Vol. 2, Issue 5, p. 54). Andalas University Press. http://eprints.undip.ac.id/43725/%0Ahttp://repo.unand.ac.id/3650/1/01.Buku-Fisiologi-dan-Patologi-Saliva.pdf

Komariah, & Rahayu, S. (2020). Hubungan Usia, Jenis Kelamin Dan Indeks Massa Tubuh Dengan Kadar Gula Darah Puasa Pada Pasien Diabetes Melitus Tipe 2 Di Klinik Pratama Rawat Jalan. *Jurnal Kesehatan Kusuma Husada*, 41–50.

Ningsih, A. W., Wiyono, W. I., & Jayanti, M. (2023). Hubungan Lama Menderita Diabetes Melitus Tipe 2 Dengan Kejadian End-Stage Renal Disease Di RSUP Prof. R. D. Kandou. *Jurnal Kesehatan Tambusai*, *4*, 1231–1236.

Nirmala, A., & Sultana, M. (2021). Estimation of Salivary Protein as A Potential Biomarker For Diagnosis of Type -II Diabetes Mellitus. *Bulletin of Environment, Pharmacology and Life Sciences*, *10*(March), 256–260.

Umam, K., Ramdhani, Y., & Zulfikar. (2017). Efek kadar albumin terhadap perbaikan klinis pasien TB di Instalasi Pelayanan Tuberkulosis Terpadu (PTT) RSUDZA. *Jurnal Ilmiah Mahasiswa Kedokteran Biomedis*, *2*(4), 8–14. https://jim.unsyiah.ac.id/FKB/article/view/6762

Vaziri, P. B., Vahedi, M., Abdollahzadeh, S. H., Abdolsamadi, H. R., Hajilooi, M., & Kasraee, S. H. (2009). Evaluation of salivary albumin in diabetic patients. *Iranian Journal of Public Health*, *38*(3), 54–59.

Zhang, C. Z., Cheng, X. Q., Li, J. Y., Zhang, P., Yi, P., Xu, X., & Zhou, X. D. (2016). Saliva in the diagnosis of diseases. *International Journal of Oral Science*, *8*(3), 133–137. https://doi.org/10.1038/ijos.2016.38